A
Mechanical ESSAY
UPON THE
HEART.

In Three Anatomical LECTURES,

WHEREIN

I. The HEART is demonſtrated to be a compleat Epitome of *Myology* in general, from a new and particular Illuſtration of its compounding Muſcles.

II. The Origin and Nature of the BLOOD, with a very exact Deſcription of its Circulation; deduced from the Force and Elaſticity of a Fibre; from the Situation and Conſtruction of the Veins and Arteries; and from the ſtated Principles of Mechanicks.

III. The Præternatural State of that Fluid; and how to reſtore it, when poſſible, to its natural *Craſis* again.

As deliver'd at

The GULSTONIAN LECTURE in the Amphitheatre of the *Royal College* of *Phyſicians*, *London*; on the 23d, 24th, and 25th Days of *October*, 1727.

By *WILLIAM WOOD*, M. D.
Fellow of the ſaid COLLEGE.

Illuſtrated with COPPER-PLATES.

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TO

HIS GRACE

JOHN,

Duke of *MONTAGU*,

Marquiſs of *Mont-Hermer*, Earl *Montagu*, Viſcount *Mont-Hermer*, Baron *Montagu*, Maſter of the *Great Ward-Robe*, Lord Lieutenant of the County of *Northampton*, Lord Lieutenant and *Cuſtos Rotulorum* of *Warwickſhire*, Lord Proprietor and Captain-General of the Iſlands of *St. Lucia* and *St. Vincent*, Knight of the Moſt Noble Order of the *Garter*, and Grand Maſter of the moſt Honourable Order of the *BATH*, &c.

SIR,

YOUR GRACE's free and generous Condeſcenſion to Subſcribe the Statutes of our *Royal College of Phyſicians*, juſtly commands a very particular Acknowledgment from every individual Member thereof, for ſo great and ſingular an Honour done him upon that Occaſion.

'TIS upon this Account, GREAT SIR, that I preſume to dedicate theſe following *Lectures* to Your GRACE, hoping your uſual Complaiſance and Good-Nature will excuſe the Boldneſs of this Attempt; and, as I meant it, look upon it as an Inſtance of my profound Reſpect and Gratitude.

DUTY, My LORD, and a ſort of Vaſſalage is a farther Obligation upon me to make Your GRACE this humble Offering. At preſent I enjoy a ſmall Cuſtomary Eſtate where your Noble Anceſtors have long been Lords Paramount. Indulgent Fortune has made Your GRACE a Guardian, as it were, over me in that Reſpect, and I hope You will vouchſafe me the Honour of Your Countenance and Protection in this.

THE Subject treated of in the following Sheets, My LORD, is the *Heart*; that glorious Fountain thro' which the ennobled Blood of the *MONTAGU'S* has for many Ages paſt ſtream'd with an unblemiſh'd Tide. A long and happy Continuance thereof in Your GRACE, for the Service of the Crown, for the Ornament of Your Country, and for the common Good of Mankind, is the ſincere Wiſh of Your GRACE's

Moſt dutiful and
Moſt devoted humble Servant,

W. WOOD.

THE
PREFACE.

T*HE Uſeful and Honourable Profeſſion of Phyſick is now arriv'd at a very extraordinary degree of Perfection, by the many nice and accurate Diſcoveries of the antient and modern* Anatomiſts. *All the Literati have generouſly from time to time communicated whatever they judged curious and new in this way, ſo that any one Phyſician with a tolerable competency of this ſort of Knowledge, may, with an unprejudiced Knack of Reaſoning, in a purely mechanick way, eaſily epxlain the whole Animal Syſtem, diſtinguiſh the various Cauſes of almoſt all Diſtempers from their Effects, and accordingly preſcribe with Succeſs and Reputation.*

SO abſolutely neceſſary is Anatomy *in the Practice of Phyſick, that without it all is Random and Chimæra.* Anatomy *is, as it were, the Pole-ſtar both to guide and direct us. It points out to us the Seat and Origine of all Maladies: It diſcovers the Communication of one part with another; and ſo conſequently, like* Ariadne*'s Clue, conducts us through the, otherwiſe, inextricable Labyrinth of complicated and different Symptoms, which are as neceſſary to be known, as neceſſary to be reliev'd.*

WHEREAS, on the contrary, a Phyſician, who is not expert in Anatomy, muſt be eternally perplex'd with almoſt every Caſe he meets. He's forced every now and then to preſcribe in the dark, without either a Why or a Wherefore; and often loſes his Patient by not knowing the real Cauſe of the impending Danger. Upon this account, *RECEIPTS and Family* Noſtrums, *which too many are ſo very fond of, have ſeldom or never their deſir'd Effects, tho' poſſibly writ by the beſt Hand in the Profeſſion of* Phyſick; *becauſe theſe Receipts were originally deſign'd for other Patients, tho' probably labouring under the ſame Diſtemper: for ſo different are Conſtitutions, that 'tis very difficult, if not impoſſible, to find two Perſons exactly agreeing in every Circumſtance; nay, the very individual Perſon, when viſited a ſecond time with the ſame Diſtemper, muſt very often be treated after a very different Proceſs from the former; a great many Circumſtances ſo requiring at that critical Juncture.*

THE Peruvian Bark *is juſtly call'd a Specifick Remedy in intermitting Fevers; but it is only to be underſtood as ſuch when properly order'd: for let the Drug be never ſo good in its Nature, yet it is ſtill meliorated by the Skill of an able Phyſician; neither its Quantity nor Quality availing, as thouſands by woful Experience can atteſt, who have hand over head taken an extravagant Quantity either to no purpoſe, or a very bad one.*

IN ſhort, all good Medicines are really ſpecifick Remedies when judiciouſly apply'd, and directed to proper Diſeaſes. Hence all Cures wrought by the help of Receipts, are at beſt but gueſs-work; and Miſcarriages this way ſhould never bring any good Medicine into contempt, becauſe the very beſt in the hands of a Bungler are very often attended with very fatal Conſequences. Thus a great many (otherwiſe Perſons of very good Senſe) have taken extravagant Prejudices againſt the Bark, *for Inſtance,* Mercurial Preparations, Opium, *&c. merely becauſe ſome Friend or Acquaintance of theirs have ſuffer'd by the unskilful Adminiſtration of ſome of the abovesaid Medicines. But to return:*

ANATOMY, *as it is the Touchſtone of Practice, ſo it naturally leads us in the real and mechanical Operation of Drugs, as well as the Rationale of an Animal Body. That* *vaunted, but trite Sham of Old and Experienced, as well as being long acquainted with a Perſon's Conſtitution, is ſo ſtale a Banter upon Mankind, that none can ſwallow it down at this time of day but ignorant or unthinking People. 'Tis true, ſomething may be ſaid for long Experience when attended with a Rationale of Anatomy; but without that Rationale, Experience is neither better nor worſe than downright Quackery and Impoſture. As for a long Acquaintance with a Patient's Conſtitution, that is a mere Juggle too, for a dextrous Phyſician will find out that pretended Secret by asking three or four Queſtions at moſt.*

AGAIN, ſo indiſpenſably neceſſary is Anatomy, *that 'tis impoſſible to read and reliſh a good Author in* Phyſick *without it. Without a competency of this ſort of Knowledge, ſeveral have even quite loſt the very means of attaining to a tolerable Pitch in their Profeſſion, by a blind and implicit Reſignation to ſome pompous Hypotheſis, tinſell'd o'er with a pack of whimſical and unintelligible Terms.*

A Student in Phyſick *muſt proceed in that Method which the Schoolmen call* Synthetica; *he muſt advance by a regular Climax, from the moſt ſimple things to the moſt compounded; and then he can never be at a loſs upon any Emergency. His* Anatomical Elements (*as* Euclid's *does a young Mathematician) will infallibly direct him in the ſearch of an infinity of undeniable Truths: For an Human Body is the Epitome of every other Machine that is or ever will be invented; and every part of an Human Body, as well as the whole, is as capable, when rightly underſtood, of as nice and mathematical Demonſtrations, as any other part in* Mechanicks *or* Natural Philoſophy.

HENCE the many and voluminous Books which have been writ upon Practice, are, at beſt, but ſo many worthleſs Quack-Bills foiſted upon Mankind to introduce the Authors of them to a little Vogue in their Profeſſion: For in Phyſick, there is a Je-ne-ſçay-quoi, *which can neither be taught nor* *learn'd. A* Phyſician *muſt reaſon himſelf into this Science from the Elements of* Anatomy *by a truly mechanical Turn of Thinking. By this means he finds out and diſtinguiſhes the real Cauſe of his Patient's Complaint, and can demonſtrate the Certainty of his Proceſs in the Cure. Thus he preſcribes according to the Dictates of Nature, and may juſtly prefer his own Judgment built upon ſuch a Foundation, to a Sett of ridiculous and dogmatical Syſtems.*

UPON this View, Dr. GULSTON, *formerly Fellow of the* Royal College of Phyſicians *here in* London, *Founded and Endow'd theſe* ANNUAL LECTURES. *He knew how abſolutely neceſſary* Anatomy *was to the underſtanding of the Practice of* Phyſick; *and order'd that ſome particular part of an Human Body, by way of Introduction, ſhould be read upon; thence to demonſtrate the Phænomena of every Diſtemper incident to that Part, and to aſſign a proper Cure accordingly. In theſe following* LECTURES *upon the* HEART, *which I read (in obedience to the Command of our worthy Preſident, Sir* HANS SLOANE) *in our* Amphitheatre, *I have obſerv'd the Direction and Intent of the Founder, as exactly as I poſſibly could.*

HOW my Performance may pleaſe, I dare not ſay. If it meets with Approbation, I have my deſir'd Wiſh upon ſeveral Accounts; if it does not pleaſe, I hope ſome of my Readers, at leaſt, will be ſo candid as to inform me how to correct it, both for my own ſake in particular, and for that of the Republick of Phyſick *in general: The whole Animal OEconomy, with the principal Phænomena in Practice, depending upon an exact Knowledge of theſe very Solids and Fluids which I have attempted in theſe* LECTURES.

A
Mechanical ESSAY
UPON THE
HEART, &c.
In Three LECTURES.

LECTURE I.

THE Worthy Dr. GULSTON, formerly Fellow of this *Royal College of Phyſicians*, who inſtituted this *Anatomical Lecture*, directed that it ſhould be read upon ſome particular Part or Parts of an Human Body, with the proper Diſtempers incident thereunto; wiſely conſidering the abſolute Neceſſity which every Practitioner in Phyſick lies under, to know exactly the Anatomy of the Part affected, in order to find out the true and real Cauſe, before he can judiciouſly effect the Cure.

THEREFORE, in perfect Obedience to our generous Benefactor's Will, I ſhall, as minutely as I can poſſibly, deſcribe the conſtituent and concomitant Parts of the Heart, which is the Subject allotted me, in this Lecture.

IN the next Lecture, I propoſe to explain the Nature and Origin of that Fluid call'd *Blood*, with its proper Veſſels of Conveyance, namely, the Veins and Arteries, by way of Introduction, the better to demonſtrate how the Circulation of the Blood, in its natural State, is perform'd in an Human Body.

BY this Method, I ſhall be the better enabled to ſhow where and how the Malady begins, and conſequently be the better intitled to propoſe a Remedy, which I humbly offer to the Judgment of this learned Aſſembly: And this will be the Subject of my third and laſt Lecture upon the Heart.

TO begin;

THE Heart, in Figure, reſembles an obtuſe Cone, whoſe Apex or Point hangs downward, a little inclining to the left Side. In this Situation, the right *Auricle* is lower than the left. Its Baſe, which is uppermoſt, is ſuſpended in the Center of the *Thorax* by thoſe great Veſſels, which are inſtrumental in conveying the Blood to and from the right and left *Sinus's* of the Heart. [*See* Fig. 1. Plate 1.]

THE Heart is included in a Membranous *Capſula*, or Bag, call'd *Pericardium*, of the ſame Shape and Figure with itſelf, lying in that Duplicature of the *Pleura*, which is call'd *Mediaſtinum*, becauſe it divides the Cavity of the Breaſt into two equal Parts.

THE *Pericardium* adheres very firmly to this Membrane, and its Point is ſtrongly ty'd to the middle Tendon of the *Septum tranſverſum*, as was firſt obſerved by the famous Dr. *Lower*, to facilitate its *Diaſtole* in Expiration: But the *Pericardium* is looſe in Quadrupeds, leſt it ſhould impede its *Syſtole* in Inſpiration.

THE *Pericardium* contains a *Lympha*, which ouzes partly from its proper Glandular Coat, and partly from a number of other little Glands, which are form'd by the *Coronary* Veins and Arteries, and lie buried in the fat Subſtance upon the Baſis of the Heart. This Liquor, like that which iſſues from the *Lachrymal-Glands* of the Eyes, is of infinite Uſe to moiſten the Heart. Thus are its Fibres preſerv'd from growing dry and criſpy, which otherwiſe would neceſſarily ſhrivel and corrugate, and ſo be render'd unfit for that conſtant and regular Motion which is ſo eſſential to Life.

THE *Pericardium* has its Blood-Veſſels from the *Mammariæ* and *Phrenicæ*. It has one particular Vein call'd the *Capſulary* Vein, which carries the Blood back into the *Axillary* Vein; but all its Veins elſe are call'd after the Arteries. It has ſeveral ſmall Twigs of Nerves which ſpring from the Recurrent and *Par Vagum*. It has *Lymphaducts*, which diſcharge the ſuperabundant *Lympha*, juſt mention'd, into the *Thoracick Duct*. It has likewiſe five Perforations, or Holes for the Exit and Entrance of the great Blood-Veſſels of the Heart.

THE Heart, which is the principal and moſt noble Bowel of the whole Body, is a ſtrong compacted Muſcle compoſed of Arteries, Veins, Nerves, Lymphaticks, a Membrane, and fleſhy Fibres.

THE Arteries are call'd *Coronariæ,* and are two in number. They ſpring from the *Aorta,* a little before it paſſes out of the *Pericardium,* and immediately behind the *Valvulæ Semilunares.* One of them runs down the foreſide of the Heart in the Furrow which lies between the two Ventricles, where it ſends off a great many Branches, which dip into the various Complications of the Fibres; and having reach'd the Apex, it mounts again, and inoſculates with the other which iſſues from the right-ſide of the *Aorta,* near the firſt, and runs obliquely down between the right *Auricle,* and the right Ventricle towards the back part of the Heart. Theſe Arteries, as well as the Veins, are call'd *Coronariæ,* becauſe they divide into a great many ſmall Branches, and form a *Plexus* like a Crown, which ſurround the Baſis. They bring conſtant Supplies of Blood to warm and regale the Heart. [*See* Fig. 3. Plate 1. Fig. 1. Plate 1. and Fig. 3. Plate 2.]

THERE are likewiſe two Veins call'd *Coronariæ,* for the reaſon aforeſaid. Theſe unite with the Capillary Branches of the Arteries, carry back the remainder of the Blood, and diſcharge it in the *Vena Cava,* a little before it enters the right *Auricle.* [*See* Fig. 2, 5. Plate 1.]

THESE Veins alſo communicate with one another by *Anaſtomoſes*; and a Liquor injected only into one of them runs into the other.

THE Heart has likewiſe ſeveral *Lymphatick* Veſſels, which diſcharge themſelves in the *Thoracick* Duct.

THE Heart has Nerves from the *Par Vagum,* or eighth Pair, which form a Plexus, call'd *Cardiacus.* Theſe Nerves enter in at the Baſe, but chiefly about the *Aorta* and left

Ventricle, and afterward inſinuate themſelves through the whole Subſtance of the Heart to invigorate it with animal Spirits.

THE Heart is circumſcrib'd by a very fine Membrane, which adheres ſo firmly to its muſcular Fibres, that it is very difficult to ſeparate them. Immediately underneath this, lies a fatty Subſtance, but more particularly upon the Baſis at the Exit and Entrance of the four great Blood-Veſſels. This Fat is of wondrous Uſe to lubricate, and conſequently to facilitate their Motion in the various *Syſtoles* and *Diaſtoles* of the Heart.

IN the Baſis of the Heart lie ſeveral Tendons, which ſurround the left Ventricle, and the *Áorta.* The Entry of the right Ventricle is likewiſe tendinous, but the Fibres which terminate about the Pulmonary Artery, terminate fleſhy. Theſe tendinous Ringlets, like ſo many Ferrels, not only ſerve to fortify theſe great Veſſels at their Union with the Baſis of the Heart, but are of infinite Uſe and Contrivance for the Riſe and Inſertion of all the Fibres which compoſe the Heart. Theſe Tendons, like Cartilages in old Men, grow bony in ſeveral Animals; and ſometimes they are found *Oſſified* in Men. [*See* Fig. 1. Plate 2.]

THE Fibres, which run from, and are inſerted into theſe Tendons, are in different Plans, and lie upon one another in different Directions, being wound up together like a Clue of Thread.

FOR the Heart, as it is the Epitome of all Muſcular Motion in Nature, ſo it is an Abſtract or Compendium of Muſcular Conſtruction in general; the Fibres, which form this Bowel, containing all the different Species of Muſcles in Animal Life. The number of all theſe different Species of Muſcles is reckon'd eight by *Borelli*, Cap. 2. Prop. 3. of his incomparable Book *De motu Animalium.*

THIS I am going to exemplify in the Myological Deſcription of this wonderful Machine. And as the Attempt is intirely new (to the beſt of my Knowledge) ſo I hope, ſhould I not exactly ſucceed, I am in a great meaſure excuſable upon that account.

I proceed thus:

li Priſ- i directi.

THE firſt of theſe eight Species is a Range of fleſhy Fibres in form of a rectangular Priſm, and are accordingly call'd *Muſculi Priſmatici directi.* [*See* Plate 2. Fig. 2.]

THUS that Plan of Fibres, which is the firſt and outmoſt, and by much the fineſt of all, runs at right Angles from their Origin in the Tendon of the right Ventricle, and from the ſide of the Pulmonary Artery in ſtraight Lines, and terminate on the Point of the Heart, which exactly agree with this firſt Species. [*See* Plate 2. Fig. 7.]

li boi-

THE ſecond Species is from Fibres running obliquely from their Riſe, and form an oblique-angled Priſm, and are commonly call'd *Muſculi Rhomboidales.* This Species is evidently ſeen lying immediately under the ſtraight Fibres of the Heart juſt mention'd. They have their Origin from the Tendons encircling the *Aorta* and left Ventricle, winding obliquely to the right ſide downwards to the Apex, when they aſcend again by ſeveral ſpiral Circumvolutions upon the left Ventricle, till they reach the Baſis of the Heart, where they are inſerted. [*See* Plate 2. Fig. 7, & 3.]

i Spi- bicu-

THESE Windings form likewiſe the third Species of Muſcles, which are call'd *Muſculi Spirales Orbiculares.* [See Plate 2. Fig. 2, 3, 4, 6, & 7.]

THE next Range of Fibres in the Heart are likewiſe *Rhomboidales*, and run directly contrary to the laſt, namely, from the right ſide to the left, and winding about both Ventricles, mount again ſpirally to their Inſertion in the Tendons of the Baſis. This Plan, with the laſt, being both oblique Priſms, form a fourth Species, call'd *Muſculi Decuſſati.* [*See* Fig. 7. Plate 2.] Decuſſati.

UNDER the ſtraight Fibres there are a few which almoſt run in right Lines iſſuing from the oppoſite ſides of the Pulmonary Artery, and are inſerted into the ſecond Tendon of the *Aorta* on one ſide, and into the Mouth of the right Ventricle on the other. Theſe two Plans of Fibres are reducible to the fifth Species of Muſcles, call'd *Muſculi Penniformes.* [*See* Fig. 1. Plate 2.] Muſculi P niformes.

FROM the firſt Tendon of the *Aorta*, there are ſeveral other Fibres deſcending half-way downwards obliquely to the Apex, making a few ſpiral Circumvolutions round the right Ventricle, aſcend afterwards either to be inſerted into the Tendon of the Pulmonary Artery, or loſe themſelves in the fleſhy Pillars, or *Papillæ* in the inſide of the right Ventricle.

FROM what I have already explain'd, it is evident, that all the Fibres, which compoſe the Heart, iſſuing from the Tendons in its Baſis, like ſo many Rays from a common Center, form the ſixth Species, call'd *Muſculi Radioſi.* And, again, 'tis no leſs evident, that the Tendons which give Riſe to theſe Fibres, and where moſtly they are inſerted, being only ſo many Ringlets of a finer ſort of Fibres very firmly and cloſely compacted, form a ſeventh Species of Muſcles, call'd *Sphincteres Circulares*; which will appear more plain in the Sequel of theſe Lectures. [*See* Fig. 1. Plate 2.] Muſculi dioſi. Sphincte Circulare

BUT beſides theſe Tendons, there are likewiſe Semicircular Fibres which ſurround the two Ventricles, which are of extraordinary Uſe in aſſiſting the Valves during the *Syſtole* of the Heart.

FROM the various Windings of the Fibres, which I have been ſpeaking of, are form'd the right and left Ventricle, which, by unravelling the Clue, ſeparate themſelves from each other, and are intirely diſtinct. The left Ventricle is much ſtronger, having a great many more Fibres winding about it than the right Ventricle. The left is narrower and longer; but the right Ventricle is the wider and ſhorter of the two, and ſeemingly the larger in Capacity: the left has likewiſe more Nerves entring into it, in proportion to its Fibres. They have a Partition-Wall, which is call'd the *Septum.*

THE *Septum* is a ſtrong fibrous Part, being exactly of the ſame Subſtance with the Ventricle. From its Tendon in the Baſis of the Heart, go all the Fibres which compoſe it, ſome of them running in ſtraight Lines, terminate in the Apex; others, at all the intermediate Diſtances, twiſt themſelves round the left Ventricles. In their Circumvolutions they are wove with the *Decuſſati* mention'd above, and form the eighth and laſt Species, call'd *Muſculi Complicati, ſive Muſculi compoſiti ex faſciculis Fibrarum complicatarum.* Theſe Fibres afterwards either are inſerted into the Baſis on the oppoſite ſide, or terminate in fleſhy Pillars, or *Papillæ*, in the inſide of the left Ventricle. This *Septum* is convex on the ſide of the right Ventricle; and in regard of this Ventricle's Weakneſs, it ſends off a pretty ſtrong and round Muſcular Plan of Fibres, which ſurround its greateſt Circumference. [*See* Fig. 2. Plate 2.]

ſculi mplicati.

THE left Ventricle lies on the oppoſite ſide of the *Septum*, which is concave, and makes a part of the inſide of the Ventricle, having, as I obſerv'd but juſt now, a great many of its Fibres interwoven with thoſe that conſtitute it. Therefore, tho' the *Septum* generally belongs to both the Ventricles, yet it more particularly belongs to the left. [*See* Plate 1. Fig. 4.]

THE Inſide of both Ventricles has a great many Furrows, which are much deeper and larger, and likewiſe more in Number in the left than the right.

IN the Cavities of both Ventricles there are alſo a great Number of fibrous Productions, long and round, different both in Shape and Size. Theſe are the Fibres which did not mount outwardly, to be inſerted with the others in the Tendon of the Baſis of the Heart, but terminated in the Cavity, to form the *Papillæ* or *Columnæ*. The right Ventricle, being much thinner than the left, has a tendinous Pillar of ſeveral Fibres running from the *Septum*, or middle Partition, to its oppoſite Side, to prevent too great a Dilatation in its *Diaſtole*, and to aſſiſt in the *Syſtole* of the ſaid Ventricle. [*See* Fig. 4. Plate 1.]

THE other fibrous Productions, riſing moſtly from the Bottom of the Ventricle, mount upwards in tendinous Strings to be inſerted into the *Valves*, call'd *Tricuſpides* from their Triangular Figure. Theſe *Valves* are made of a thin ſtrong Membrane, and are circularly inſerted into the Tendon, which ſurrounds the Mouth of the right Ventricle. [*See* Fig. 5. Plate 1.]

IN the left theſe fibrous Productions (as in the right) go to be inſerted into the *Membranæ Mitrales*: So call'd from their Likeneſs to a Mitre. Theſe Membranous *Valves* are circularly inſerted into the Tendon, which ſurrounds the left Ventricle. [*See* Fig. 4. Plate 1.]

ADJOINING to the Baſis are two more Cavities as Appendages to the Heart, lying upon the two Ventricles, which are call'd *Auriculæ*, from the Reſemblance they have of an human Ear. They have an obtuſe Point, which, with their Baſe or Origination, form an Obtuſe Triangle. They are divided into right and left Auricles becauſe of their Situation. They are compos'd of two Plans of Fibres, which are oblique Priſms, and decuſſate each other. They have their Origin from a circular Tendon, which joins the *Vena Cava* on the right Side, and the *Vena Pulmonalis* on the left. Theſe two Tendons are firmly faſten'd to the common Tendon of the Heart for their Support. The Fibres compoſing theſe two Auricles wind about 'em, and terminate in the common Tendon oppoſite to their Origination. The right Auricle is ſofter, and, like the right Ventricle, ſeemingly larger than the left, which is ſtronger and more compact than the right. Their Cavities are unequal like thoſe of the Ventricles, having Furrows, which in the left are more in Number, and deeper than in the right. They have alſo ſeveral fibrous Pillars, which croſs one another, terminating in their proper Tendons. The Auricles, as well as the Ventricles, have their *Syſtoles* and *Diaſtoles*, but alternately; the Auricles receiving their Blood from the Veins, while the Ventricles throw their Blood into the Arteries. They have their Arteries from the *Coronariæ*, which are by ſome call'd *Arteriæ Auriculares*. Theſe bring the Blood for their conſtant Nutrition, and the *Reſiduum* is remanded back into the *Cava* by the Coronary Veins. They have their Nerves from the *Par Vagum*. They have Lymphaticks, which diſcharge themſelves into the *Thoracick Duct*. [*See* Fig. 1, 2, 4, 5. Plate 1.]

THE *Vena Cava* has ſeveral reddiſh and fleſhy Fibres, which ſurround its Trunk near its Entrance into the right Ventricle; and the ſame Sort of Fibres are found at the Root of the *Vena Pulmonalis* near its Entrance into the Left.

NEAR the Union of the *Vena Cava aſcendens* and *deſcendens*, is an *Iſthmus*, commonly call'd *Tuberculum Loweri*. [*See* Fig. 2. Plate 1.] This Protuberance is made by a Production of the Coats of theſe two Veſſels, and directs the Blood of each into the right Auricle. In Beaſts, whoſe Poſition is Horizontal, this Protuberance is not ſo viſible; only the Veſſels have a little Bent by way of Direction to the right Auricle.

IN the *Cava*, juſt oppoſite to the *Cava aſcendens* near the *Iſthmus*, is the *Foramen Ovale*, which is always found in *Fœtus's*. This Hole opens into the *Vena Pulmonalis*, on which Side it has a Valve which hinders its Return back again. [*See* Fig. 2. Plate 1.]

THERE is likewiſe another Duct or Canal in *Fœtus's*, which riſes from the Pulmonary Artery and runs into the *Aorta*. This Conduit is call'd *Ductus*, or *Canalis Arterioſus*, and degenerates into a Ligament ſoon after the Child is born, the Blood circulating then thro' the Lungs.

THE *Aorta* and the *Arteria Pulmonalis* have three ſimilar Valves, call'd *Sigmoidales*, becauſe they reſemble the *Greek* Letter *Sigma*, which was anciently written like our C. Theſe Valves are likewiſe call'd *Semilunares*, from their Likeneſs to an Half-moon. Theſe Valves are of a membranous Subſtance, and ſpring circularly from the Tendons of the Heart. Each Valve is convex on its Side next the Heart, and concave on the other, by which extraordinary Contrivance they are more peculiarly uſeful for the End which Nature deſign'd them. For tho' they have not the additional Supports which the *Mitrales* and *Tricuſpides* have, yet they ſufficiently perform their Office as Valves. A very perfect Idea of the Uſe and Office of all theſe Valves may be had by injecting of Water thro' the *Oſtium*, or the Cone of the Heart: or preſſing the Cone when the Heart is half full of Water. [*See* Fig. 3, 4, 5. Plate 1.]

HERE I finiſh this Lecture upon the Anatomy of the Heart, having deſcrib'd every conſtituent Part thereof as juſtly and minutely as I could. I have deſignedly omitted giving or aſſigning any particular Uſe of thoſe Parts, eſpecially the muſcular Fibres: Firſt, becauſe theſe will naturally explain and illuſtrate themſelves in deſcribing how the Circulation of the Blood is perform'd; and, ſecondly, to avoid as much as I poſſibly could

Tautology, being under an unavoidable Neceſſity to repeat 'em in my next Lecture; which will be upon the Nature and Origin of that Fluid call'd Blood, with its proper Veſſels of Conveyance, by way of Introduction; the better to demonſtrate how the Circulation of the Blood is perform'd by the Machinery of the Heart, through the Veins and Arteries in an Human Body.

LECTURE II.

THE Blood is an heterogeneous Fluid, compoſed from the various Particles of Animals and Vegetables, which are our conſtant and daily Food. Nay, even thoſe very Animals and Vegetables are again compounded, participating more or leſs of their native Soil and Nouriſhment.

THE very Water which we drink is compounded, receiving ſeveral Particles from the different Earths it paſſes through: Nor are the Aliments only compounded in themſelves, but even again undergo more Changes from their Entrance in at the Mouth, to their mixing with the Blood in the Subclavian Vein. Now the Blood having its conſtant ſupplies from theſe Aliments, 'twill be proper to ſhew how they are prepar'd and fitted for this neceſſary Purpoſe: which is thus.

IN the Mouth they are chew'd, when the Muſcles, imploy'd in Maſtication, preſſing upon the neighbouring Glands, ſqueeze out the *Saliva,* which mixes with the Aliments, and moiſtens them ſufficiently to be ſwallow'd down into the Stomach; which is perform'd by proper Muſcles thro' the Gullet, whoſe longitudinal and circular Fibres convey them quite down thro' the ſuperior Orifice of the Stomach.

THE Aliments being arriv'd here, they receive a freſh Supply of Liquor to dilute them, from the glandular Coat of the Stomach, which is innermoſt. Then the third Coat, which lies between the nervous one and fourth, which is a Production of the *Peritonæum*, compreſſes this Maſs according to the Direction of the Fibres, which run partly in ſtraight Lines from the upper Orifice to the *Pylorus*, and partly in circular ones from the upper Part to the Bottom of the Stomach obliquely.

THUS the Cohæſion of all the *Moleculæ* of the Aliments, by a Force nearly equal to 250734 Pound Weight, and with the Aſſiſtance of the inhærent Air, is broke: And the Aliments, being ſo far digeſted, are, by the ſaid Force, expell'd the Stomach through the *Pylorus* into the *Duodenum*. Afterwards the ſtraight-lined and ſpiral Fibres of the ſecond Coat of the Inteſtines (forming a Motion call'd *Periſtaltick*, or *Vermicular*) drive the ſaid digeſted Aliments down to the lower End of the *Duodenum*, where they meet with another Liquor, call'd *Bile*.

THIS *Bile* is a Juice ſeparated from the glandular Subſtance of the Liver, and depoſited in the *Veſicula Fellis*, or Gall-bladder, by an infinite Number of biliary Ducts. Now, the Stomach being diſtended with Food more or leſs, proportionably ſqueezes this Bladder, whence the *Bile* flows through the *Ductus communis Cholidochus* into the Place aforeſaid.

ADJOINING to this, or very near, opens the *Ductus Pancreaticus Virtſungi*, which brings another Liquor, which is prepar'd in the *Pancreas*, being a Gland of the conglomerate Kind. Here the two Juices blend with the chylous Subſtance deſcending from the Stomach, where by the Fluidity of the one, and the Acrimony of the other, their little *Moleculæ* are farther diluted and broken. The *Impetus* of the Periſtaltick Motion, and the Preſſure of the Midriff, and the Muſcles of the lower Belly, force the finer Parts of the Chyle, ſo prepar'd, thro' the *Papillæ Inteſtinorum*,

rum, which lay on the innermoſt Tunick of the Inteſtines in the upper Side of the *Valvulæ Conniventes.*

PEQUET calls this Tunick, or Lining, a ſpungy *Periſtoma.* *Bilſius* calls it a woolly Moſs. And *Willis*, *Glanduloſa*, or *Tunica villoſa Inteſtinorum.* Thro' theſe *Papillæ* the *Chyle* is percolated, when 'tis receiv'd by a Multitude of capillary Tubes iſſuing out of the ſmall Guts. Theſe capillary Tubes uniting ſoon after, form larger Branches, call'd, *Venæ Lacteæ primi generis*, and carry the *Chyle* to the Glands of the Meſentery, partly by the Force communicated as aforeſaid, and partly from a *Lympha*, which is ſecreted from the capilliary Arteries of the Guts continually running thro' theſe fine Canals; which Stream both dilutes, and drives the *Chyle* along with it thro' the lacteal Veſſels, to prevent its Obſtruction, which would be of fatal Conſequence to the Individual.

FROM theſe Veſicular Cells the *Chyle* is carried by Lacteals of a larger Diameter, call'd *Lacteæ ſecundi generis*, to the *Receptaculum Chyli.*

EUSTACHIUS was the very firſt that diſcover'd the Lacteals, but never knew their Uſe. Next *Aſſellius* diſcover'd them above an hundred Years ago, imagining they convey'd the *Chyle* to the Liver, (the ſuppoſed Fountain of Sanguification.)

THE *Receptaculum Chyli*, with the *Ductus Thoracicus*, were found out by *Pequet* almoſt eighty Years ago. This Receptacle lies under the deſcending Trunk of the *Aorta*, and the *Vertebræ* of the Loins. Its greateſt Diameter is between the cæliack and emulgent Arteries, and environ'd by a great many veſicular Glands, *viz.* the *Glandulæ Lumbares.* Theſe Glands, with thoſe of the *Abdomen* and Legs, ſend a large Quantity of *Lympha* again to dilute, and with the Pulſations of thoſe neigbouring Arteries preſs the Bag conſtantly to propel the *Chyle* into the Thoracick Duct.

THIS Tube has ſeveral Valves at proper Diſtances, and runs up on the left ſide of the *Thorax*, under the *Aorta deſcendens*, along the *Vertebræ*. The Valves, which are concave upwards, reſiſt the *Chyle*'s returning down again. Therefore when this Liquor, contain'd in the intermediate Spaces beween the Valves, is ſqueez'd by the Vibration of the ſaid *Aorta*, *&c.* and not finding a Paſſage down again, from the Reſiſtance of the inferior Valve, forces itſelf thro' the yielding ſuperior one; and ſo by degrees climbs up to the left ſubclavian Vein, into which it opens with one, ſometimes two Orifices.

ON the Inſide of this Vein are two ſemi-lunar Valves, covering theſe Orifices; and faſtened ſo, that the Current of the refluent Blood may gently ſlide over them. By this Orifice neither the Blood can enter the Duct, nor gravitate upon the *Chyle* to prevent its Aſcent; and here it is that it enters the Blood, and with it aſſimilates by gradual Circulations.

HENCE 'tis evident, that the *Chyle* being a Compound, the Blood muſt be ſo too; ſince the firſt is not only the *Pabulum*, but the very *Materia prima* of the latter.

I have been thus particular upon the *Chyle* for ſeveral Reaſons, which will ſufficiently appear in this and the enſuing Lecture.

THE Veſſels which the Blood paſſes thro' are the Arteries and Veins. The Arteries carry the Blood from the Heart, and the Veins bring it back again. The Arteries are conical Tubes, whoſe common Baſe ſprings from the left Ventricle of the Heart, and their *Apex* at their Evaneſcence into Veins, which Veins are inverted Arteries. The *Apex* of every Vein is at its *Anaſtomoſis* with the *Apex* of the Arteries, and their common Baſe opens into the right Ventricle of the Heart.

THE Arteries have three Coats; the firſt of theſe is a fine Net-work of Veins, Nerves and Arteries, which are very curiouſly wove into each other, and run into the other two, particularly the ſecond, to nouriſh and invigorate them with Blood and animal Spirits. The ſecond Coat is made of ſeveral *Strata* of ſpiral Fibres, ſpringing from the Tendon of the *Aorta* in the Left Ventricle, winding very cloſely towards the *Apex*, or Evaneſcence; and continued to form the Vein in the ſame Manner, till they are inſerted into the Tendon of the right Ventricle.

AS the Artery is the thickeſt where its Diameter is greateſt, ſo the Thickneſs of this Coat is in Proportion to the Number of theſe *Strata* of muſcular Fibres.

THE third Coat is a fine, but ſtrong and diaphanous Membrane. This being innermoſt, is prodigiouſly ſmooth, that the Blood might ſlide eaſily and freely along in its Circulation. This Membrane likewiſe ſecures the ſpiral Fibres from ſeparating from one another in the Dilatation of the Artery, and keeps the Blood firmly to its proper Channels.

THE Veins being only a Continuation of the capillary Arteries, their Coats are much the ſame in a more remiſs Degree; only, on the Inſide of moſt of the Veins, which are perpendicular to the Horizon, there are ſeveral hollow Valves, whoſe concave Side is next the Heart.

THESE Valves are the Productions of that fine and tranſparent Membrane juſt mentioned; and their Office, like their Figure, is exactly the ſame with the Valves in the Lacteals.

HAVING explain'd the Structure of the Heart, the Veins and Arteries, and the Fluid from whence the Blood is made; I proceed, according to my propoſed Method, to ſhew how the Blood circulates thro' an Human Body.

THE Blood is the Projectile, and the Heart is the *Vis Motrix*, or *Primum Mobile* of the Blood's Motion. Now, in order rightly to underſtand how this Motion is effected by the Heart in the Compound, it will be perfectly neceſſary to premiſe a Word or two by way of Explanation of the Nature of thoſe particular conſtituent Parts which more immediately contribute to this Motion; and thoſe are the Fibres, which compoſe the Muſcular and Tendinous Parts of the Heart.

A Fibre is a Cylindrical Tube made up of a fine and denſe Elaſtick Membrane: which Membrane is again compoſed of finer Fibres, and ſo on beyond our Capacity, to analyze and diſtinguiſh even with all imaginable Artifice.

A Fibre contains a Fluid, which is ſeparated from the Blood-Veſſels and Nerves, to nouriſh and aſſiſt it in its Motion, which is Contraction. For this Fluid being compreſs'd by the Tenſion of the containing Part, its Diameter being leſſen'd, the Axis is lengthen'd: therefore when the Cauſe of the Tenſion is remov'd, the Fibre contracts again, and the Fluid being preſs'd longitudinally, it increaſes its Diameter, and conſequently ſtretches the Sides of the Tube circularly; and by this means the Fibre is, in a great meaſure, aſſiſted in its Contraction.

THAT Fibres do contract, is evidently demonſtrable both from the Muſcles that have Antagoniſts, and thoſe that have none. For inſtance, in thoſe that have no Antagoniſts, as the Stomach, which always contracts till the Digeſtion is over, the *Uterus* and *Veſica*, with all the *Sphincters*, contract immediately after their Tenſion and the Cauſe of it is diſcharg'd. In Muſcles which have Antagoniſts, upon dividing of one, the other contracts immediately, and the two Segments of the

Muſcle ſo divided, retire, one to its Inſertion, and the other to its Origination.

THEREFORE, as every muſcular Fibre contracts naturally of itſelf, as ſoon as the Force which diſtended it ceaſes; the Circulation of the Blood through the Heart will appear very plain.

TO begin with the Right Side of the Heart: Let us ſuppoſe the refluent Blood juſt ready to enter the right Auricle, which Auricle we will likewiſe ſuppoſe to be in its *Syſtole:* now, as the Venal Blood moves conſtantly, tho' ſlowly, the *Cava*, at its entrance into the ſaid Auricle, muſt of conſequence ſwell by an accumulation of the refluent Blood, whilſt the Auricle is in its *Syſtole.* The *Syſtole* being over, the *Diaſtole* inſtantly ſucceeds it; when the tendinous Circle opens, which, like a *Sphincter*, had tied up the Mouth of the Ventricle ſo cloſely during the *Syſtole*, that not one Drop of Blood could either enter in, or return into the *Cava.*

THE Auricle being now in its *Diaſtole*, the accumulated Blood in the *Cava* ruſhes into the Auricle partly by its own impreſs'd Motion, and partly by the Contraction of thoſe fleſhy Fibres which ſurround the Trunk of the *Cava* at its entrance into the right Auricle.

THUS the *Cava* has its *Syſtoles* and *Diaſtoles* alternately with the right Auricle, tho' but very faint ones in compariſon. By this contrivance, the ſlow Motion of the venal Blood is accelerated, and conſequently ſprings with a greater Force into the contracted Auricle: Thus it is more effectually and ſooner diſtended; and, therefore, muſt neceſſarily both contract with more Force, and a greater Celerity: Re-action being always equal to Action both in Time and Force.

THIS Contraction is performed by the two Orders of oblique priſmatick Fibres, which decuſſate each other in their Conſtruction of the Auricle. Now, all Muſcles contracting according to the Direction of their Fibres from their Origin to their Inſertion; the ſtrongeſt Contraction will be always in that part of the Fibre which is the fartheſt from its fix'd Points. For Example, a Chord extended between two fix'd Points, and vibrated, the greateſt Vibrations will be always found in the middle of the ſaid Chord, and conſequently the moſt forcible. Therefore I conclude, that the Blood in all the Cavities of the Heart receives the greateſt Impulſe at the greateſt Diſtance from, and leſſer proportionably as it approximates, or comes nearer to the Tendons which ſurround the Mouths of theſe Cavities. This Contrivance prevents any the leaſt drop of Blood from being left behind in the *Syſtole.* For had the Vibrations been leſs quick in the bottom than they are, ſome of the Blood might have been left behind, from a too ſudden Contraction of the Fibres about the Mouth of the Cavity.

BUT another very extraordinary good Effect enſues upon this: for the principal Deſign of this Muſcular Contraction was not only to drive out the Blood, but to give it a force proportionable to the Rout it was to take, namely, by a ſtrong Impulſe from behind. Hence it is evident, that the Blood is propell'd out of the Cavities of the Heart by a compounded Motion, *viz.* by a circular and direct, or ſtraight-lined Impulſe.

BUT to return to the Right Auricle.

IN its *Syſtole* it propels the Blood into the Right Ventricle, which is in its *Diaſtole* then; into which Ventricle the Blood ſtill ruſhes till it is ſufficiently dilated, and then ſucceeds the *Syſtole*; which is thus.

THE right-lined Fibres, which run from the Tendon of this Ventricle, and from the Side of the Pulmonary Artery, and are inſerted in the Apex, ſhorten the Heart when they contract; and the two *Rhomboidales* decuſſating each other, and winding ſpirally, contract accordingly. The *Penniformes* likewiſe, which ſpring from each ſide of the Pulmonary Artery to be inſerted on one ſide to the Tendon of the *Aorta*, and to the Tendon of the right Ventricle on the other, contracting, dilate the Mouth of the Pulmonary Artery. The Fibres likewiſe which it receives from the *Septum*, with thoſe which it has in common with the left Ventricle, jointly contracting, expel the Blood thro' the Pulmonary Artery into the Lungs. In the *Syſtole*, the Communication between the right Ventricle and Auricle, is entirely cut off by the *Valvulæ Tricuſpides*, which is thus:

THE *Papillæ* in the Contraction, when the Heart is conſiderably ſhorten'd, relaxing the Valves, fly up and ſtop the Paſſage where they are ſupported by the tendinous Strings before deſcribed, which terminate in the Tip of their Angles. But when the Heart is in its *Diaſtole* again, it lengthens, and draws the Valves back again by the tendinous Strings, to give admittance to the Blood from the right Auricle.

THE Blood being now got by the *Valvulæ Semilunares*, they oppoſe its return the ſame way again by their concave Sides, like Water-Gates: And the *Vis impreſſa* from the right Ventricle, forces it thro' the ſmall Branches of the Pulmonary Artery, which are join'd to the Branches of the *Vena Pulmonalis* by *Anaſtomoſes*. The ſmall Branches of theſe Veſſels are interſperſed quite thro' the whole Subſtance of the Lungs running along the Sides of the *Bronchi*, and the little Lobes of the Orbicular Veſicles.

HERE, by the Gravitation of the Air, which is commonly reckoned to be equal to an hundred Pound weight, the Blood is compreſſed, and its Motion proportionably accelerated. The grumous Particles are very much broke, and conſequently the whole Maſs, by this Contrivance, muſt be made more fluid, and as it were, refitted for its next Voyage round the Miſcrocoſm.

NOW as the Air, ruſhing into the Lungs by the *Trachea Arteria*, ventilates and gives a Paſſage to the Blood into the Branches of the *Arteria Pulmonalis:* ſo upon Expiration, or the Exit of the Air, the Cavity of the Thorax is contracted by its proper Muſcles, and the Blood, by the Preſſure of the Lungs upon its Veſſels, is forcibly repelled through the *Vena Pulmonalis* into the left Auricle.

AT the Entrance of this Vein, there are likewiſe a great many fleſhy muſcular Fibres as a check upon the too great Redundancy of the accumulating Blood, while the left Auricle is, as I obſerved before of the right Auricle, in its *Syſtole:* When the Blood has entered the Auricle, it is thrown into the left Venticle, which was then in its *Diaſtole*; the tendinous Circle round the Mouth of the Auricle contracting, and ſo preventing the Blood's return back again to the pulmonary Vein during its *Syſtole.* When the left Ventricle contracts, the *Papillæ* relaxing, as in the right Ventricle, the *Valvulæ Mitrales* ſpring up into the Paſſage where the Blood enter'd to prevent its return into the right Auricle again.

NOW as the Blood which is ſent hence through all the Arteries to every the remoteſt Part of the Body muſt have a Force proportionable to thoſe Diſtances, ſo Nature has contrived its Strength accordingly, being conſiderably thicker, and having more Plans of Fibres ſurrounding its Cavity, than the right Ventricle. The *Septum* likewiſe, which makes up a Part of this Ventricle being very ſtrong and compact, ſends off a great many Fibres, which ſurround and embrace it from Top to Bottom. Now, when all theſe act together, the Force is wonderfully augmented. The ſtraight Fibres, which run from the Tendon of the *Septum*, being very numerous and terminating in the *Apex*; contract and ſhorten the *Axis* of the Heart, daſhing as it were the Tip of the Heart againſt the *Fundus* of this Cavity with the greateſt and moſt viſible Vibrations of any, whilſt the Spiral Fibres preſſing laterally, the Blood is totally expelled, and the Inſides cloſely compreſſed by the means of a great many deep Furrows, which are in this and all the Cavities of the Heart, being deeper, and more in Number in Proportion to the Strength of their reſpective conſtituent Parts.

THE Blood being thrown into the *Aorta* with ſo great a Celerity, it muſt neceſſarily preſs with a proportionable Force againſt the Sides of this and every Artery circularly, as it moves along: till the ſpiral Fibres which compoſe their ſecond Coat, contract and compreſs the Blood back again from the Circumference to the Center. But as the Sides of the Arteries converge or incline nearer one another, as they move along, the Blood will be driven more obliquely to the internal Circumference of the Tube in the *Diaſtole*, and more obliquely *vice verſa* in the *Syſtole*. And thus is the arterial Blood driven by a compounded and an inteſtine Motion to the Evaneſcence of the Arteries, or their Inoſculation with the capillary Veins, (the *Valvulæ Sigmoidales*, which are faſtened on the Tendon where the *Aorta* begins, preventing the Blood from being Retrograde.)

IT is to be obſerved by the way, that the Evaneſcence of an Artery does not always terminate in and immediately communicate with a capillary Vein. The *Arteria Cœliaca* running into the Spleen, diſcharges its Blood through the capillary Branches into an infinite Number of membranous Cells or Cavities, which communicate with one another, being different in Figure and Bigneſs. From theſe Cells the Blood is carry'd back again by the capillary Veins of the *Ramus Splenicus*. The Circulation of the Blood through the Brain is the ſame. The Carotyde Arteries diſcharge the Blood in the ſeveral *Sinus's* which is brought back by the jugular Veins, their capillary Branches communicating with the ſaid *Sinus's*. But to return.

WHEN the Blood is got into the Veins, it moves ſlow, but conſtantly, which in the Arteries moves *per ſaltum*. In the Veins there is no ſenſible Pulſe, the Blood moving by gradual Climaxes, which are Valves. Theſe Valves are like the Halfs of Acorn Cups placed circularly on the Inſide of the Veins at certain Diſtances, with their Cavities towards the Heart. Thus the communicated Motion of the Blood from the Arteries aſcends the Summit of the firſt Valves which ſuſpend it, and prevent its Gravitation upon the next that follows; this next preſſes againſt the Valves which ſupported the firſt, and drives it to the next Valves, and ſo the Blood moves on in a progreſſive Motion till it reaches the right Ventricle of the Heart again. This progreſſive Motion from another Contrivance is very much facilitated, *viz.* from the diverging of the Sides of the Vein from the Fluid; and again the contiguous Muſcles preſſing upon the Veins, add to this Motion in the very ſame manner mentioned of the Chyle in its Aſcent thro' the Lacteals and Thoracick Duct.

THUS all the refluent Blood from the Head and Arms, is brought by the *Cava Aſcendens*, and from the re ſtof the Body by the *Cava Deſcendens*. Near the Union of theſe two great Veins there is a Protuberance called *Tuberculum Lowerí*, which directs the Streams of theſe Veſſels, and at the ſame time ſupports the Weight of the deſcending Blood from falling counter to the aſcending, which would otherwiſe ſtop the Circulation.

IN *Fœtus's*, the Circulation differs from what I have already explain'd, in this particular: The Lungs having never been diſtended with Air, lie heavily preſs'd together, ſo that the Blood cannot freely paſs from the right Auricle to the left by the Pulmonary Vein and Artery; therefore it muſt have another Rout, which is thus:

THE Blood being brought from the *Placenta* by the Umbilical Vein into the *Vena Portæ*, it paſſes by a ſtraight Canal into the *Cava*, and ſo is carry'd thro' the *Foramen Ovale* into the *Vena Pulmonalis*, for the Reaſon aforeſaid; thence into the left Auricle, afterwards into the left Ventricle, whence 'tis diſperſed over the whole Embryon by the Pulſation of the Arteries. The Blood, which is brought by the *Vena Cava deſcendens*, being diverted from falling upon the *Foramen Ovale*, empties itſelf into the right Auricle: thence 'tis thruſt into the right Ventricle, whence the greateſt part is carried by the *Canalis Arterioſus*, which goes from the *Arteria Pulmonalis* to the *Aorta*, the Blood-Veſſels being too much compreſs'd by the weight of the Lungs for the admittance of the whole. The ſuperabundant Blood is return'd by the two Umbilical Arteries into the *Placenta*, where 'tis receiv'd by the Veins of the Mother; and ſo there is a continual Circulation of Blood carry'd on from the Mother to the Child, and *vice verſa*.

I ſhall finiſh this Lecture with an account how the right Auricle and Ventricle come to be apparently bigger than the left. I obſerv'd before, that the Organs thro' which the Blood paſſes, are thicker and ſtronger in proportion to the Force and Celerity of that Fluid: Therefore it is abſolutely neceſſary that ſome of theſe containing Parts ſhould have their apparent Bigneſs almoſt equal to their real Content, and others apparently leſs, (all Fibres contracting and reſiſting more or leſs, as their numbers are.) Now the venal Blood in the *Cava* being

ſlow,

ſlow, its Impetus againſt the Sides of the Auricle muſt conſequently be very weak, and but juſt ſufficient to fill, and gently to dilate it : whereas after the Blood has paſſed the Lungs, it becomes more fluid, and its Motion accelerated to a great degree. Thus it muſt dilate the left Auricle proportionably, that the whole Content of Blood from the right Ventricle may be exactly compreſs'd in the left. For had the Content of the right Ear been really greater, as it is in appearance, in every *Syſtole* of the Heart, the Blood would have accumulated more or leſs, till the Blood-Veſſels had burſt to pieces in the Lungs; the times of Contraction and Dilatation both in the Auricles and Ventricles being equal : Therefore it neceſſarily follows, that all the Cavities of the Heart muſt be equal in Content, tho' the Cavities on the right Side are apparently bigger than the left. Hence likewiſe we muſt conclude, that if by an Accident the Right Auricle takes in more or leſs Blood than uſual, the other Cavities, muſt receive the ſame quantity (ſtill ſuppoſing the Blood in a natural State) in their *Diaſtoles*; for in every *Syſtole*, the Cavity is entirely emptied, and ſent on to the next, till it enters the *Aorta*.

LECTURE III.

HAVING deſcrib'd the Heart, and the Nature and Circulation of the Blood in their natural State, I ſhall firſt proceed to ſhew, in this Lecture, how, and by what Gradations this Fluid may be affected in its Circulation, thence to account for the various Phænomena in a præternatural one. And afterwards I ſhall propoſe a Method of Cure, in order to regulate this Diſorder, by removing the Cauſe (where the nature of the Diſtemper will admit of it) and to reſtore the vitiated Organs to their juſt and natural Functions, and the Blood to its due Craſis again.

NOW the whole Machinary of an Human Body conſiſting of the niceſt Symmetry and Proportion of its Parts, it muſt neceſſarily follow, that a very ſlight Indiſpoſition in one place will, more or leſs, affect the reſt; ſo mutual is their Dependence one upon another. For Inſtance, THE Blood is generated from the Chyle, and the Chyle is aſſiſted by the Vibrations of the Arteries. The animal Spirits are made from the fineſt Parts of the Blood, and elaborated in the Glandular Subſtance of the Brain and *Medulla Spinalis*, from whence they flow by their proper Canals, the Nerves, to give Motion to the Solids. The Solids drive on the Blood, and the Blood accelerates the animal Spirits in their Circulation; and ſo on for all the Fluids, and their containing Solids.

BUT to return: The Blood being a Compound of Corpuſcles, which are very different in reſpect of their ſpecifick Gravities, it naturally follows, that theſe Corpuſcles, the nearer they approach to reſt, will the more eaſily ſeparate, (the heavier ſubſiding, and the lighter ones emerging.)

BUT as the Heat of the Blood depends upon the Briskneſs of its Circulation, ſo does this Separation depend upon the greater or leſs Remiſſneſs of the Heat of the Blood; for 'tis well known, that extravaſated Blood condenſes and coagulates ſooneſt, where the Intenſeneſs of the Cold is greateſt. Therefore, the greater the Languor of the Blood is, the greater will be the Diminution of its Heat, and conſequently will be render'd more liable to run into Grumes, or little concreted Clots. Thus the Blood becomes leſs fit for paſſing the fine Capillary Arteries, and, by being retarded too long and too often, a total Obſtruction will inevitably enſue, attended with univerſal Convulſions, and a trembling and irregular Pulſation of all the Arteries in general.

THIS Languor, or ill Craſis of the Blood, is generally caus'd by ſome of theſe following Circumſtances, *viz.* Firſt, either by ſome malignant Particles caſually mixing with the Blood: Or, Secondly, by ſome adventitious *Plethora*: Or, Thirdly, by ſome Diſorder in the Solids, whereby their Tone and Office is ſo far hurt or impair'd, as to affect the Circulation, and conſequently the whole animal OEconomy. And,

FIRST, Experience, and daily Obſervation, tell us, that ſuch Accidents happen almoſt continually from malignant Particles mixing with the Blood. For Example, in the Small-Pox, in peſtilential Fevers, from the Biting of poiſonous and enraged Animals, from the Nature and Quality of ſeveral Drugs, *&c.* From theſe Cauſes, I ſay, and ſuch like, the whole Maſs has been alter'd and vitiated to ſuch an extraordinary Degree, that coagulated Blood has been commonly found in the very Ventricles of the Heart, when ſuch Subjects have been open'd. The Coagulation of the Blood is ocularly demonſtrable, by injecting three or four Ounces of Vinegar into the Jugular-Vein of a living Dog. Immediately after this Operation, a few Convulſions intervening, the Dog expires, and if his *Thorax* is laid open, that moment you will find all the Blood in the *Sinus's* of the Heart fixed and congealed. This Phænomenon is eaſily accounted for, by conſidering that the Blood is only an aſſimilated or modified Chyle, or milky Fluid, warm, and in Motion, which will naturally curdle upon mixing with ſo potent an Acid.

HENCE 'tis evident, that diſſimilar and diſagreeing Particles communicating with the Blood, will vitiate its Craſis in a Space of Time proportionable to the Strength of the ſaid Particles, and that of the Patient. Again,

THE Coagulation of the Blood is very aptly illuſtrated by ſeveral curious Experiments in natural Philoſophy, particularly by the following ones, *viz.*

POUR Spirit of Salt upon the White of an Egg, and in a very little time a Coagulation will enſue. Again, if you mix good Spirit of Wine with an equal Quantity of the Spirit of

Sal Armoniac with the Salt of Tartar newly prepared; or Spirit of Wine with an equal Quantity of pure Spirit of Urine well ſhook together in a Glaſs-Bottle, they will quickly coagulate, and become a pretty hard Maſs.

NOW, if Fluids, ſo ſimple and uncompounded as the White of an Egg, and ſo fine and volatile as Spirit of Wine, can be coagulated and fixed by theſe Spirits of Salt, two of which are animal Salts, *viz.* the *Sal Armoniac* and the Spirit of Urine, it is eaſy enough to conceive how the venomous Salts of Animals, or any pernicious Particles, blending with the circulating Blood, which is ſo compounded a Fluid, as obſerved before, muſt coagulate it, and that more or leſs in proportion to the Quantity and Quality of theſe Particles ſo entering, and conſequently muſt induce a Languor, or an unnatural *Diatheſis* of the Blood.

SECONDLY, A *Plethora* will do the ſame: For when the Increaſe is greater than the Decreaſe, the Volume of the Blood muſt neceſſarily be augmented, and the containing Veſſels be ſtretch'd beyond their natural Size.

NOW, a *Plethora* may happen ſeveral ways: For Inſtance, Firſt, from too violent Exerciſe. Thus the Muſcles and their Tendons being forcibly agitated, vibrate againſt the Sides of the adjacent and contiguous Blood-Veſſels, and conſequently muſt drive on the Blood with a greater Impetus. Thus the Blood is render'd both more fluid and more hot, (Heat being the Effect of Motion) and the Pulſe beats quicker and higher. By this means the Blood being broke and comminuted by an adventitious Heat and Motion, muſt, like the tinged Spirit in the Thermometer, take up a greater Space, and conſequently diſtend the containing Veſſels beyond their natural Size. Hence comes that Faintneſs and Weakneſs from a greater Conſumption of the animal Spirits than their ſecreting Glands can ſupply; hence comes that violent Thirſt, and panting for Breath, the diſtended Veins and Arteries preſſing the *Bronchi* and orbicular Veſſels unnaturally, obſtruct the free Reſpiration of the Lungs; and hence, too often Death enſues, the common Conſequence of a too great Rarefaction of the Blood, when the Fibres muſt neceſſarily loſe their contractile Force, and the Fluid, by degrees, its Motion.

FOR tho' a muſcular Fibre naturally contracts again after its being dilated, (the Force abating) yet, like a Bow too much bent, and too long kept in that poſition, they loſe their elaſtick Force when over-ſtrain'd, and by being continually over-loaden, intirely loſe their Motion, and by degrees their very Nature too. Hence it is that the *Canalis Arterioſus*, and the two Umbilical Arteries are metamorphoſed into ſtrong Ligaments: Hence ſome of the Arteries and Tendons have been oſſify'd; hence ſeveral Muſcles have been extended to a monſtrous degree, as is evidently ſeen in an *Aſcites*, *&c.* For as Motion, and a proper and ſufficient Moiſture, is neceſſary to preſerve the very nature of a Fibre, ſo too little Motion alters its Contexture; and too much Moiſture, whoſe viſcid Coheſions clogging the fibrile *Machinulæ*, and very often totally damming up the *Vacuola* between the tranſverſe Surfaces, deſtroys its *Vis Reſtituendi*: And thus the Impreſſion upon a part, affected with an *Anaſarca*, *&c.* remains a great while after.

FROM hence it is very eaſy and natural to account for the ſurpriſing Bigneſs of the Auricles, when a *Polypus* grows in either Ventricle. I ſhall mention one particular Inſtance, and that is that of a Lady of Quality, as it was communicated to me by a worthy Fellow of this COLLEGE. The Caſe is this:

UPON opening the *Thorax*, the Heart was found three times bigger than the uſual Size, and the *Vena Cava* extended in proportion, and the right Auricle was dilated near twelve Inches in length, and five in breadth, and when open'd, it contain'd at leaſt two Pounds of Blood very much coagulated, and ſome of it concreted into ſolid Cakes, reſembling a true *Polypus.* In the right Ventricle was likewiſe a great deal of coagulated Blood, and a large white fleſhy *Polypus*, which was five Inches long, and above an Inch broad, and half an Inch thick. The left Ventricle was much the ſame with the right, the *Polypus* excepted; and the left Auricle was much leſs than ordinary, and the Liver vaſtly large. There are a great many more Particulars; but this being enough to the preſent purpoſe, I ſhall omit the reſt.

NOW to account for theſe Phænomena, and all others like them, it is to be underſtood, that a *Polypus*, or *Sarcoma*, being a præternatural fleſhy Excreſcence, and receiving Nouriſhment from its proper Veſſels, muſt neceſſarily grow ſtill bigger and bigger. Now, when ſuch an Accident happens, as in the Caſe above, it muſt in proportion to its Bulk, not only retard the Exit of the Blood, but likewiſe hinder a great deal of the Blood from being driven out by interfering and preventing the Sides from coming cloſe together in the *Syſtole* of the Ventricle, where it grows.

NOW the Auricles always contracting and dilating alternately with the Ventricles, it muſt neceſſarily follow, that the Quantity of Blood received by the Auricle in its *Diaſtole*, cannot be all thrown out in its *Syſtole* into the Ventricle, for the reaſon aforeſaid; but the refluent Blood ſtill endeavouring to force itſelf into the Auricle, when in its *Diaſtole*, both the Auricle and the *Vena Cava* muſt be prodigiouſly extended, all Fibres gradually yielding to a ſuperiour Force. Again, the Blood being ſo long retarded, muſt naturally coagulate, for a reaſon aforeſaid; and the left Auricle muſt certainly grow leſs than ordinary, becauſe in ſuch a caſe as this is, neither the

Quantity nor Force of the Blood were ſufficient to keep it diſtended to its natural Size; all containing fibrous Parts contracting or diſtending in proportion to the Force and Quantity of their Contents, as I obſerved before of the *Canalis Arterioſus, &c.* The Largeneſs of the Liver muſt be occaſion'd by the accumulating Blood diſtending the Branches of the *Vena Portæ*, and the *Vena Cava* likewiſe; the Circulation being ſo much retarded by the *Polypus* in the right Ventricle.

THE *Polypus* in the Heart, and Extenſion of the Auricles, *&c.* to ſuch a ſurpriſing Bulk, are Maladies not to be come at by the Surgeon, and conſequently incurable; for Medicines have no Power in ſuch a caſe. But to return:

A *Plethora* will happen from a too great Influx of Chyle upon an extravagant Debauch of eating or drinking, which is commonly call'd a Surfeit. Hence come violent Head-Achs, Deliriums, Lethargys, Coma's, Epilepſys, Apoplexys, and all the black Liſt of Diſtempers, which affect the Brain, Nerves, and all the contiguous and continuous Parts of the Head; the Eyes, the Ears, the Tongue, *&c.*

NOW, when the Stomach is ſo overcharged, the Fibres, if at all, can but ſlowly contract, (let the Aliments be of ever ſo eaſy a Digeſtion) and conſequently but ſlowly expel the ſolid part of the Debauch; the Blood-Veſſels therefore muſt be almoſt burſt before the Stomach can be half emptied, the more ſpirituous and fluid Parts flying off firſt, and creeping thro' the Lacteals into the Blood. Now the Volume of the Blood being ſo haſtily increaſed and thinn'd by the Sprightlineſs of the Liquors, which always in ſuch a caſe happens before the Stomach is half emptied, (unleſs by a violent Fit of Vomiting) their greateſt Force and Effects are upon the Head and ſuperiour Parts; becauſe the heavy and extended Stomach muſt neceſſarily preſs upon the deſcending *Aorta*, and ſo preſſing, muſt check at leaſt the deſcending Blood, and ſo its greateſt Quantity and Force muſt and will be turned thro' the *Carotides* and Vertebral Arteries into the Head.

NOW 'tis eaſy and natural to conceive that the Arteries muſt unavoidably be diſtended by ſo violent a Force and Quantity of Blood, and conſequently all the *Sinus's* of the Head; by this means the whole Subſtance of the Brain muſt be compreſs'd, and conſequently all the Glands, with their excretory Ducts, the Nerves, muſt be ſo too. Hence proceed all thoſe Ravages afore-mention'd, with a great many more: for it is from theſe Glands, and through theſe Ducts, that the Animal Spirits ſpring and flow. Upon theſe depend the Being of the whole Animal OEconomy; they give Motion, and Senſation, and Nutrition to every part.

NOW theſe being ſeparated from the fineſt part of the Blood, as I obſerv'd before, a proper *Diatheſis* is abſolutely neceſſary in the Blood; but in all *Plethora's*, and particularly in this, both their Secretion and Motion muſt be impeded: for a Gland being only ſo many Circumvolutions of a fine tubous Canal, and their excretory Ducts ſo many almoſt right-lined Tubes, their Sides muſt be compreſs'd, and conſequently render'd very uncapable of their proper Office, by their concomitant Parts being diſtended and diſtorted beyond their natural Size and Situation.

HENCE we muſt derive the Cauſe why the very Muſcles become flaccid and motionleſs, which in a natural State are quite the reverſe: for 'tis the ſelf-ſame Juice which both fills the tubous Fibres, and likewiſe gives them Motion, as is evidently ſeen in a *Paralyſis*, where, from the want of this Juice, the Parts are emaciated, and become void of Senſe, and Motion, and Strength.

FOR this Juice being brought here, 'tis certain, it does not ſtay and ſtagnate here; Corruption being inconſiſtent with a natural State: therefore it muſt have its proper Veſſels to return it ſomewhere after it has done its part, it being as impoſſible to return in the ſame Veſſel that brought it, as it was to come here without one.

AGAIN, it is certain, that all the Muſcles become ſtronger by their being the oftener moderately exerciſed. Thus the right Hand and Arm are generally ſtronger than the left, becauſe more generally made uſe of.

NOW, as Strength immediately depends upon conſtant Supplies of Nouriſhment, I conclude that the Fibres of all Muſcles in exerciſe, muſt, from their Contraction and Dilatation, compreſs their contain'd Fluid both laterally and longitudinally, and conſequently expel ſome part of it by its excretory Canals, to make room for a freſh recruit of animal Spirits through their proper Veſſels of Conveyance, the Nerves.

THUS the Heart is conſtantly maintain'd and invigorated, and its involuntary and inceſſant Motion kept conſtant, Accidents excepted, ſometimes above a hundred Years. This is very aptly confirm'd by the Diſtribution of the Nerves in the Subſtance of the Heart, they running in at the Baſe in greater plenty near the *Aorta*, where the Motion is the ſtrongeſt, and the Fibres moſt numerous, and *vice verſa*.

FROM hence 'tis demonſtrable how Exerciſe becomes ſo ſalutary, eſpecially ſuch as more generally vibrates the whole Syſtem of the Muſcles moderately; and in this caſe, Muſick too is extremely Uſeful and Neceſſary: For it is by this means, that the ſtagnating Spirits are laſh'd on, and circulate freely;

which gives Chearfulneſs to the Mind, and renders the Body lightſome, active, and ſtrong.

ON the other hand, 'tis as demonſtrable how thoſe miſerable Wretches, who are pamper'd and debauch'd with Luxury and crippled by an unactive, lazy way of Life, become Sacrifices to a numerous Train of Complaints, as the *Hip*, *Vapours*, *Hyſterick*, *Melancholy*, *Convulſions*, *Madneſs*, *Scurvy*, *Gout*, *Dropſy*, and *Rheumatiſm*, with a great many more Diſtempers than I ſhall name at preſent. Nay, every Wind that blows, every Change of Weather, as well as every Change of Air, brings a new Diſeaſe along with it, and they are never free one Minute, (the Effect neceſſarily following the Cauſe :) therefore all a Phyſician can do with ſuch, who will not leave their beloved, pernicious Cuſtoms, is to preſcribe at leaſt palliative Medicines, *& valeant quantum valere poſſint*.

THESE Diſtempers are unjuſtly call'd *Opprobria Medicorum*; but the fault is really in the Patient, and not in the Capacity of the Phyſician: For almoſt every individual acquir'd Complaint, if taken in time, may be cured, would the Patient undergo a proper Regimen of Diet and Exerciſe, as well as Phyſick.

AGAIN, when the Head is compreſs'd by the *Plethora* aforeſaid, Convulſions enſue. Convulſions happen when the circulating Spirits are interrupted, or totally ſuppreſs'd. Thus a Blow upon the Elbow, between the Protuberance of the *Os Humeri* and *Ulna* ſtuns and convulſes the back part of the Hand and Fingers, particularly the Little and Ring Fingers, where the fourth Branch terminates, which is made from the fourth, fifth, ſixth, and ſeventh Pair of Nerves of the Neck. Again, if you but gently ſcratch the *Par Vagum*, a little below the *Larynx* of a live Dog, he will vomit inſtantly; and if you make a ſtrong Ligature upon the *Par Vagum*, he vomits likewiſe, and dies with ſtrong inward Convulſions upon him: which ſufficiently

ciently accounts for Convulſions. Let the Diſtemper be what it will, this Cauſe produces the ſame Effect.

A *Plethora* happens likewiſe upon the Obſtruction of the Glands, and their excretory Ducts. Infinite is the number of Glands in an Human Body, which ſeparate their proper Liquors from the Blood; and are reducible to thirty-ſeven different ſorts, by the moſt accurate Anatomiſts. Now, the more general the Obſtruction, the quicker is the Blood in a *Plethora.* For Inſtance, an adventitious Cold obſtructing the Miliary Glands of the Skin when the Blood is but moderately rarefy'd, will do this effectually, by putting a ſtop to inſenſible Perſpiration; which, according to *Sanctorius*, diſcharges much more than all the ſenſible Evacuations put together. Therefore the Blood, being depriv'd of ſo great an Evacuation, muſt neceſſarily be prodigiouſly increaſed in a very little time, and the Patient thrown into a Fever. The other Glands are obſtructed from an ill Craſis of the Blood, which is generally the Effect of theſe *Plethora's*, and give the Diſtemper a Name peculiar to the Obſtruction of the Gland or Glands ſo affected.

THIRDLY, The Craſis of the Blood is very often vitiated from ſome Diſorder in the Solids, whereby the Tone and Office of their compounding *Fibrillæ*, are ſo far hurt and impair'd, as to affect its Circulation, and conſequently the whole animal OEconomy at the ſame time.

I have obſerv'd before, that the material *Primum Mobile*, or firſt Mover of the Fluids in an Human Body, and all other Animals, is a Fibre. This therefore being undeniably true, it neceſſarily follows, that the State and Condition of the Projectiles (the Fluids) and that of the contractile and diſtractile Fibres will be reciprocal; that is, the Fluids will preſerve their natural Property when their vibrating Solids are regular, and *è contra*, they muſt be vitiated, *viz.* made too thin, or too groſs and ſizy, when the ſaid Solids are diſorder'd either by an Augmentation or Diminution of their natural Elaſticity.

HENCE moſt, if not all hereditary Diſtempers may be eaſily enough accounted for, (the Defects of the very Solids in the Parents, being but too commonly and viſibly propagated in their Children.)

I ſhall here diſmiſs this Article, having all along in theſe LECTURES had a very particular Eye to the Mechaniſm of a Fibre, by obſerving, that the whole Rationale of an Human Body depends upon a nice and adequate Idea of the Tonick Motion of the Solids, and the various Modifications and Properties of their component *Machinulæ*; and conſequently every Phyſician, who would ſhine in his Profeſſion, muſt be well acquainted with the Doctrine of a Fibre, in order to make a ſure and ſpeedy Alteration in the Conſtitution of the peccant Fluids.

HAVING thus run over the common and accidental Changes which the Blood is liable to from the Cauſes above recited, 'tis eaſy enough to account for the ordinary Symptoms of Fevers in general. For Inſtance, the Quickneſs of the Pulſe is owing to the Rapidity of the Blood; the *Syſtole* and *Diaſtole* of the Blood being reciprocal in point of Celerity and Time, *i. e.* the quicker a contractile Fibre is dilated, ſo much ſooner it contracts. The Rapidity of the Blood was accounted for before. The intenſe Thirſt and Burning both internally and externally proceeds from the ſame rapid Motion; and the reaſon why the Mouth and *Cuticula* are ſo parch'd, is from an Obſtruction of theſe Ducts and Glands, which ſhould bring a proper Moiſture to them. The Irregularity of the Pulſe in every reſpect is owing to accidental Remora's from the *Moleculæ* interrupting the Circulation of the Blood through the Capillary Ar-

Arteries; hence proceeds a Deficiency of Animal Spirits, and conſequently Faintneſs, Convulſions, and, laſt of all, Death.

THE *Moleculæ* of the Blood obſtructed in the Miliary Glands of the Skin, account for the *Petechiæ* of malignant and ſpotted Fevers, and the difference of their Colour is as their Size and Duration.

THEREFORE, ſince the Quality of the Blood, in moſt caſes, depends upon its Quantity, or its containing Veſſels, or both together, proper Evacuations are abſolutely neceſſary; and, firſt, Blood-letting is proper, by Cupping, or Leeches, or opening a Veſſel with a Lancet. The laſt Method is beſt, and anſwers the End of an Evacuation more *à propos*, than either of the other two; becauſe it is perform'd quicker, conſidering the Quantity; and the diſtended Blood-Veſſels contract again and recover before a freſh Inundation ſteals in upon them; which will happen in the other two, the Increaſe being nearly equal to the Decreaſe, and conſequently the Patient is ſtill but *in ſtatu quo*. Now, a quantity of Blood being remov'd, ſuitable to the Age and Conſtitution of the Patient, which is about a fortieth part of the whole Maſs, muſt make a very ſudden and ſenſible Alteration, ſince Health and Sickneſs are ſo near an Equilibrium in Nature, and that the whole Maſs, or a Quantity equal to it, which is 25 Pound, or 400 Ounces, paſſes the Heart once every ſix Minutes. Such a Reſiſtance being taken away by this Operation, the Arteries muſt immediately recover their relaxed State, and their Vibrations will be longer in reſpect of their Centre of Oſcillation, and conſequently ſtronger. Thus the Velocity of the Blood is increaſed, the Grumous Parts daſh'd to pieces, and the remainder of the Maſs almoſt inſtantly reinſtated by this Evacuation, which makes the greateſt and ſureſt Revulſion of any.

II. ANOTHER Evacuation is by *Veſicatory*, from *Spaniſh* Flies, whoſe ſubtile cauſtick Salts, ſeparating the *Cuticula* from the *Cutis*, make room for the excretory Ducts of the Cutaneous Glands to empty the *Serum*, which ſprings from the Blood by their ſtimulating Quality: for theſe Salts vellicating the Sides of the containing Veſſels, rouze the languid and ſtagnating Fluids, break their Coheſions, and throw off the peccant Load thro' the Blyſter, the Pores, and by Urine, (a due Care being had to prevent a Strangury.) By the aſſiſtance of Cantharides, we ſee the Sick daily redeem'd from the Grave, who muſt otherwiſe have inevitably yielded to a haſty Fate.

III. An *Emetick* breaks the Blood, diſcharges a vaſt Quantity of Humours by its Vellication of the Fibres of the Stomach. In this Operation, the Liver and the Spleen are prodigiouſly ſqueez'd by the Convulſions of the Stomach, and the Muſcles of the *Abdomen*. Thus the ſlow-moving Blood is accelerated, the Inteſtines and *Meſentery* being preſs'd, drive on the refluent Blood below; and the Lungs being compreſs'd by the *Diaphragm* from the convulſive Motion of the Stomach are freed from a tough Flegm. Thus the Blood circulates eaſier; the Reſpiration becomes freer; and the certain Conſequence is a kind and copious Perſpiration. And,

IV. A *Cathartick* operates the ſame way as an *Emetick*; only this in the Stomach, and that in the Inteſtines. A *Cathartick*, by twitching the Bowels ſtrongly, increaſes the Periſtaltick or Vermicular Motion from the *Pylorus* downwards: by which means a vaſt Drain of Humours are carry'd off from the *Meſenterick* Glands: But a great many Particles of a *Cathartick*, ſtealing through the *Papillæ Inteſtinorum* into the Blood, irritate the Veſſels, and contribute even this way too, to alter and meliorate the whole Maſs of Blood both in Quantity and Quality.

AS there are ſeveral Diſtempers which are the Effects of the ill Craſis of the Blood, ſo they muſt be cured accordingly. Thus a *Suppreſſio Urinæ* with proper Diureticks; a *Suppreſſio Menſium* with ſtimulating and deobſtruent Medicines; and ſo on.

BUT ſometimes it happpens that the Glands and their Excretory Ducts are too much dilated by ſome extraordinary Shock from a *Plethorick* Habit. Thus firſt, a *Plethora* affects the Breathing, as I obſerv'd before, which if not ſpeedily remov'd, affects and ulcerates the very Subſtance of the Lungs; thence ariſes a tickling Cough, which increaſes gradually; thence a præternatural Agitation of the Blood, as it paſſes from the right to the left Side of the Heart; thence a ſlow Fever, which keeps time with the Ulcerated Lungs; and thence immoderate Night-Sweats.

BY the like Gradations we account for the laſt Stages of a *Diabetes*, when the Urine is as ſweet as the Chyle it is produced from, occaſion'd from a too great Diſtenſion of the Veſſels in the Kidneys. Now, to cure theſe, and ſuch like Complaints, when it is not too late, is by Agglutinants, Aſtringents, and Balſamicks, *&c.* of which the *Materia Medica* affords a very plentiful Variety.

HENCE all, or moſt of the Chronick Diſeaſes derive their Origin, the very Solids warping into an unnatural Situation, as well as the Fluids into Corruption, by too long a Continuance of the firſt Shock.

A Chronick Diſtemper is but difficultly cured at beſt; proper Alteratives being the likelieſt Method, with a proper Regimen of Diet and Exerciſe, with Reſtoratives in the concluſion. Now the beſt Reſtorative (when nothing forbids it) is Cold

Bathing; for Cold naturally contracts all Fluids, as I obſerv'd; and when the Blood is ſo condenſed, the Fibres are more at liberty to return again to their natural Tenſity: but cold Water contracts the very Solids themſelves too, and by degrees reſtores a languiſhing and decay'd Conſtitution, to a miracle. The coagulated Blood will be comminuted, the Animal Spirits ſpring afreſh, a loſt Appetite is reſtored, and all the Functions of Life carried on again with Vigour and Exactneſs.

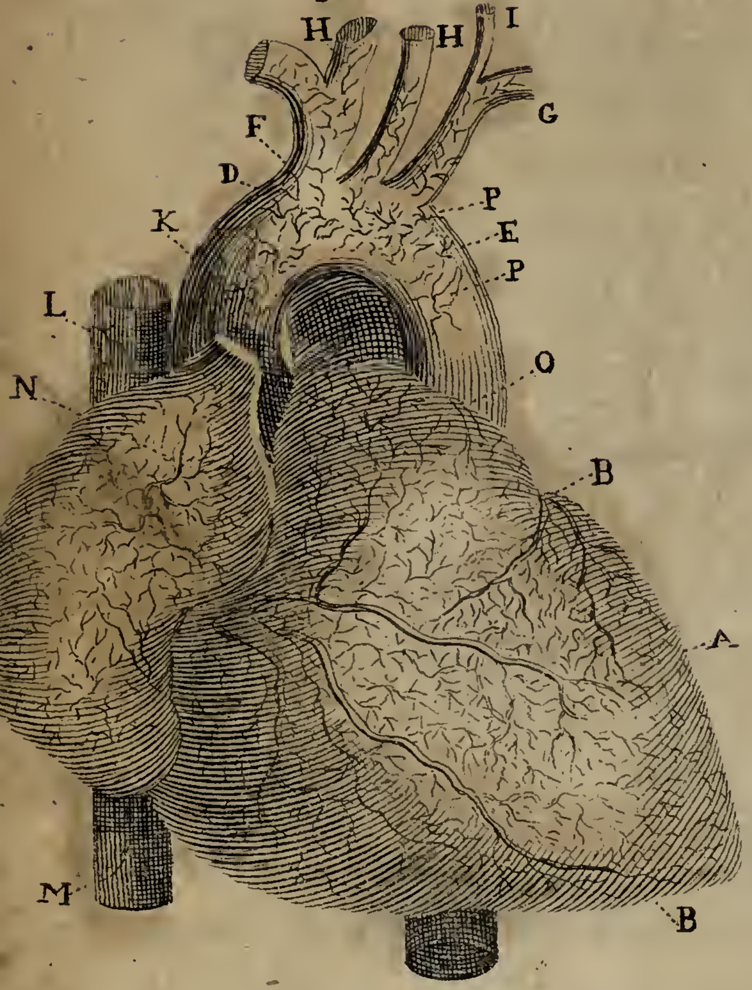
I come now to the Concluſion of theſe LECTURES; and at preſent ſhall but curſorily obſerve to you, that there is but one general and infallible Rule, which is really worthy of a Phyſician's Obſervation in the whole Circle of a Rational and Mechanical Practice. The Rule is this, *To adjuſt and preſerve an Æquilibrium between the Solids and the Fluids.*

HOW this is to be done, may in a great meaſure be deduced from theſe LECTURES. But if Leiſure and Inclination invite me, I may probably, ſome time or other, explain more fully and more methodically, the various Properties of both the Solids and Fluids, in order to ſpecify and demonſtrate this one, and only Rule of Practice, in the different Phænomena of ſuch Diſtempers as are commonly incident to the whole Race of Mankind.

PLATE

Plate. I.

Fig. 1.



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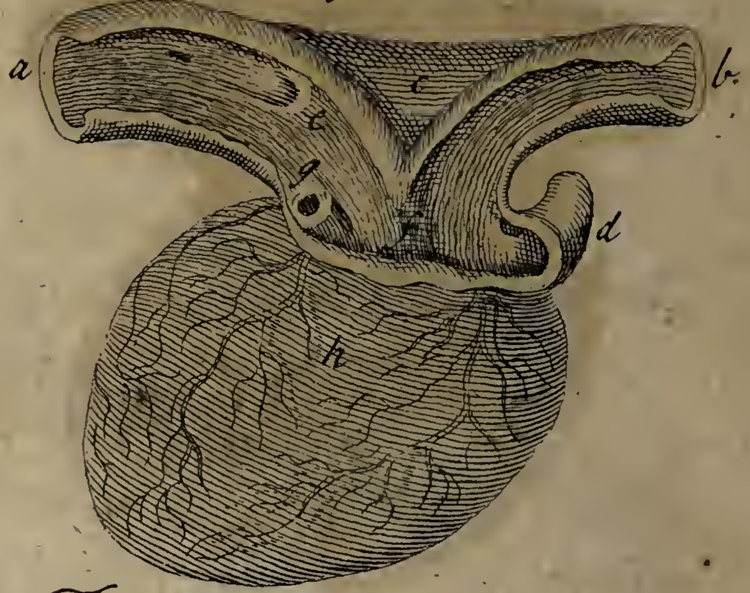

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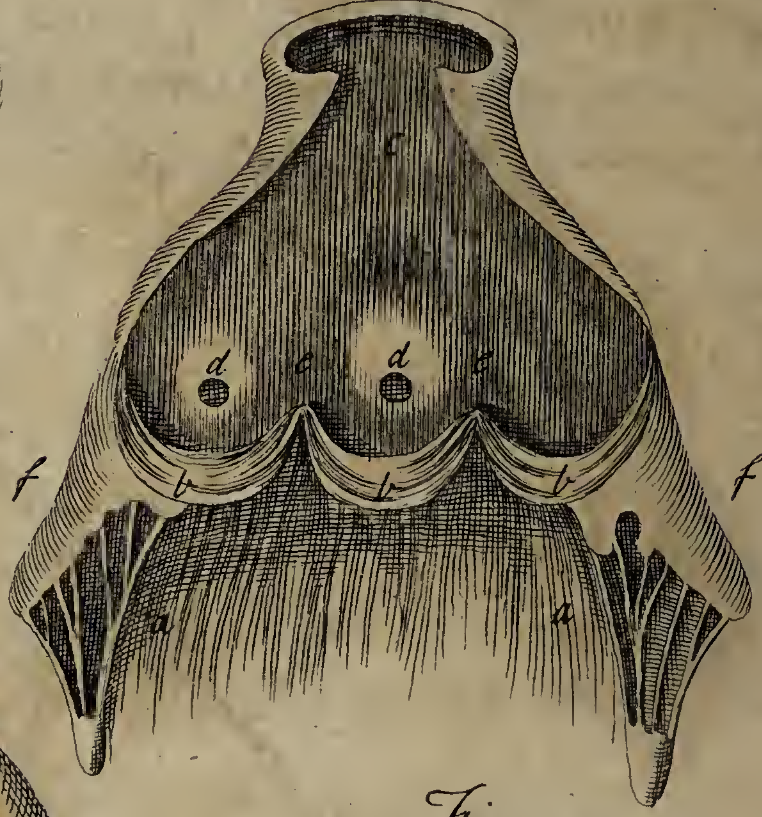

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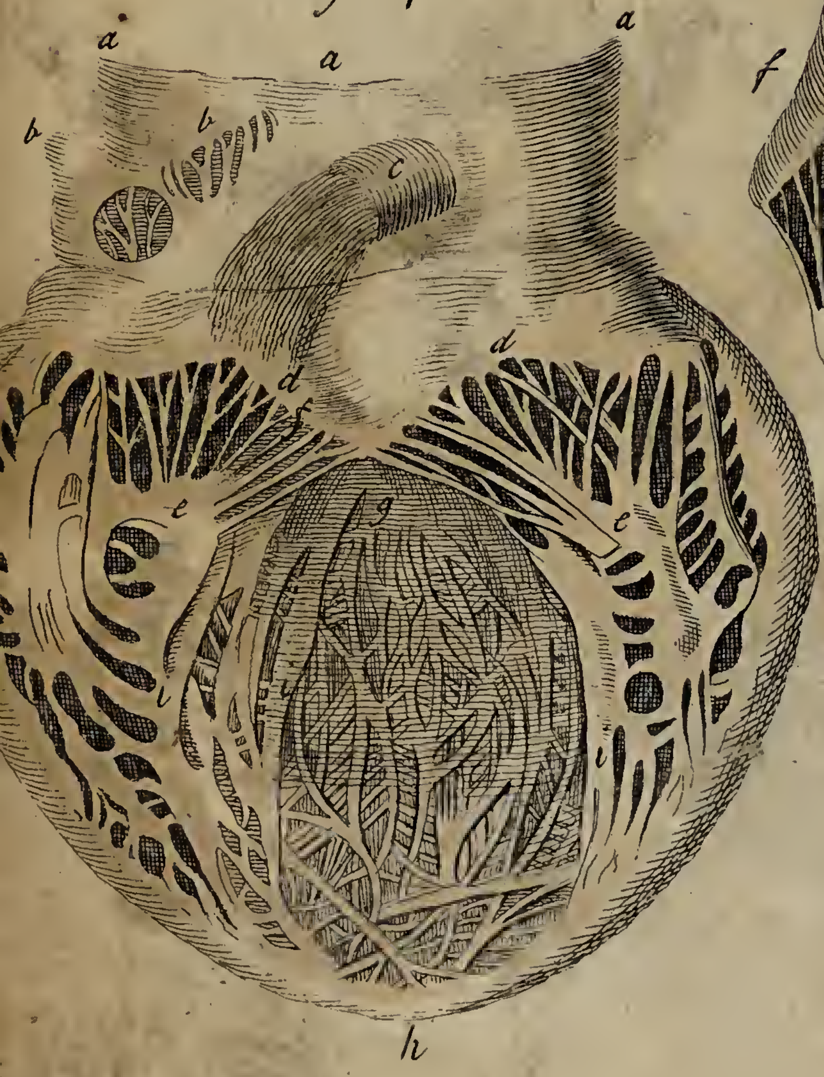

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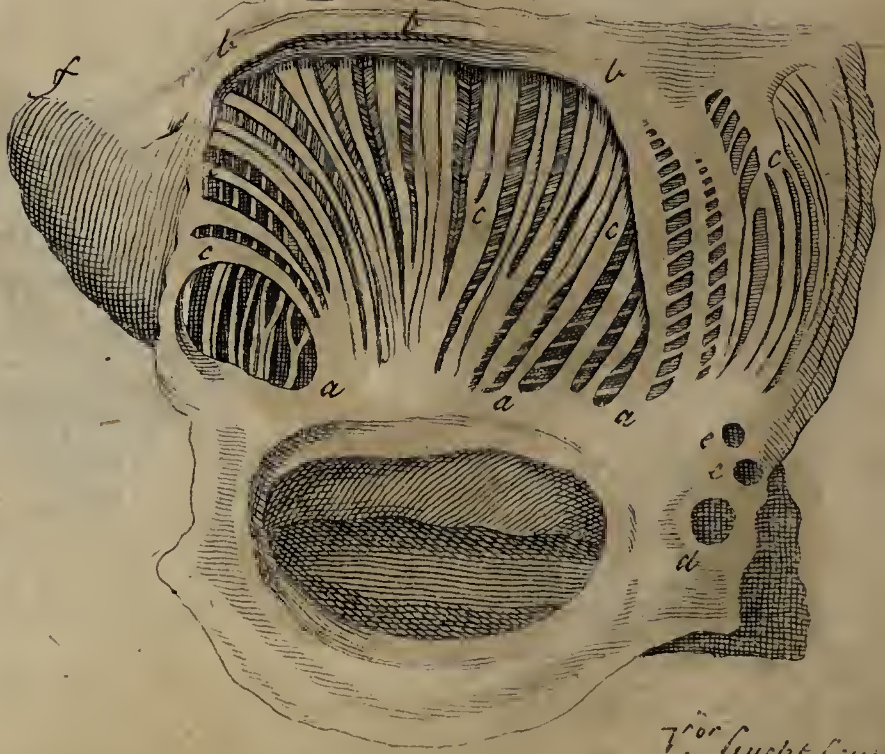


V.der Gucht Sculp.

PLATE I.

FIGURE I.

REpreſents the Heart *in Situ,* with the *Pericardium* ſtript off.

A. and B. the *Coronary* Arteries running on each ſide of the Heart from the Baſis to the Cone of the Heart. *N.B.* The *Coronary* Veins run in the like manner.

C. The right Auricle.

D. The *Aorta* ſpringing from the left Ventricle of the Heart.

E. The *Aorta deſcendens.*

F. The right Subclavian Artery.

G. The left Subclavian Artery, with the adjoining left Cervical Artery.

H. H. The right and left *Carotid* Arteries.

I. The left Cervical Artery.

K. The ſmall Arteries running from the *Coronary* Arteries upon the *Aorta.*

L. The Deſcending }
M. The Aſcending } Trunks of the *Vena Cava.*

N. The *Coronary* Arteries running upon the right Auricle.

O. The Root of the *Pulmonary* Artery riſing from the right Ventricle of the Heart.

P. P. The little Arteries ſpringing from the *Mammary* Arteries, and running upon the Coats of the *Aorta.*

FIGURE II.

Repreſents the Paſſage of the Venal Blood into the right Side of the Heart.

a. The Trunk of the *Vena Cava aſcendens.*
b. The Trunk of the *Vena Cava deſcendens.*
c. The Iſthmus call'd *Tuberculum Loweri.*
d. The right Auricle.
e. The *Foramen Ovale.*
f. The immediate Entrance into the Heart.
g. The *Coronary* Vein.
h. The Heart with the Branches of the *Coronary* Veins.

FIGURE III.

Repreſents a Segment of the *Aorta* at its exit out of the Heart, with the *Mitral Valves,* (reſembling the *Valves* called *Tricuſpides* in the Riſe of the *Pulmonary* Artery, as it paſſes out of the right *Ventricle.*)

a a. Some part of the left *Ventricle.*
b b b. The three *Semilunar Valves.*
c. The Inſide of the *Aorta.*
d d. The *Coronary* Arteries riſing immediately behind the Valves.
e e. The Root of the *Aorta* adjoining to the Tendon of the Heart.
f f. The *Membranæ Mitrales* divided, and turn'd on each Side to ſhew the ſaid Valves.

FI-

FIGURE IV.

Repreſents the Inſide of the left Ventricle.

a a a. The Pulmonary Vein.
b b. The left Auricle.
c. The *Foramen Ovale,* where the Blood flows out of the *Cava* into the Pulmonary Vein.
d. d. The Mitral Membranes.
e. e. The *Papillæ* and *Columnæ* of the left *Ventricle.*
g. The Place where the Blood is ſent forth into the *Aorta.*
h. The Cone of the Heart.
i i i. The fibrous Productions of the left *Ventricle.*

FIGURE V.

Repreſents the Inſide of the right Ventricle.

a a a. The Baſis of the Right Auricle, where 'tis united to the Tendon of the Heart.
b b b. The tendinous Circle whereby 'tis diſtinguiſh'd from the *Vena Cava.*
c c c. The fleſhy Fibres which run to the oppoſite Tendons.
d. The *Coronary* Vein.
e e. Other leſſer Veins for the refluent Blood.
f. The upper Part of the ſaid Auricle.

PLATE

PLATE II.

FIGURE I.

Repreſents the Baſis of the Heart, with the *Oſtia*, ſurrounded with their Tendons, *&c.*

a. The Entrance of the Blood from the *Vena Cava* into the right Ventricle.

b. The *Oſtium*, or Opening through which the Blood is driven out of the right Ventricle into the Pulmonary Artery.

c. The Entrance of the Blood by the Pulmonary Vein into the left Ventricle.

d. The Aperture through which the Blood paſſes from the left Ventricle into the *Aorta.*

e e e e. The Tendons ſurrounding the *Oſtia* of the Heart.

f f f f. The Origin and Inſertion of the Fibres in the Tendons of the Baſe.

g g g g. The Inſertion of the interior Fibres which run in an oppoſite Range to the exterior, and terminate in the ſame Tendons.

FIGURE II.

Repreſents the Firſt and Outmoſt Plan of Fibres.

a a. The Baſis of the Heart.

b. The Apex, or Cone of the Heart.

c c c. The ſtraight or right-lined Fibres, which run upwards towards the Baſe upon the external Superficies of the right Ventricle.

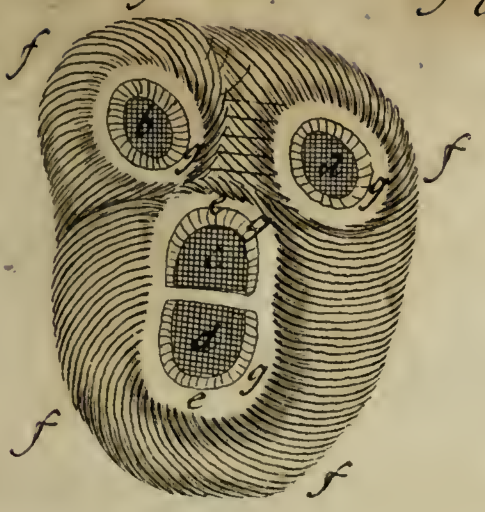
FIGURE III.

Repreſents the ſecond Plan of Fibres.

a. The Baſe, and } of the Heart.
b. The Cone }

Plate II.

Fig. 1.



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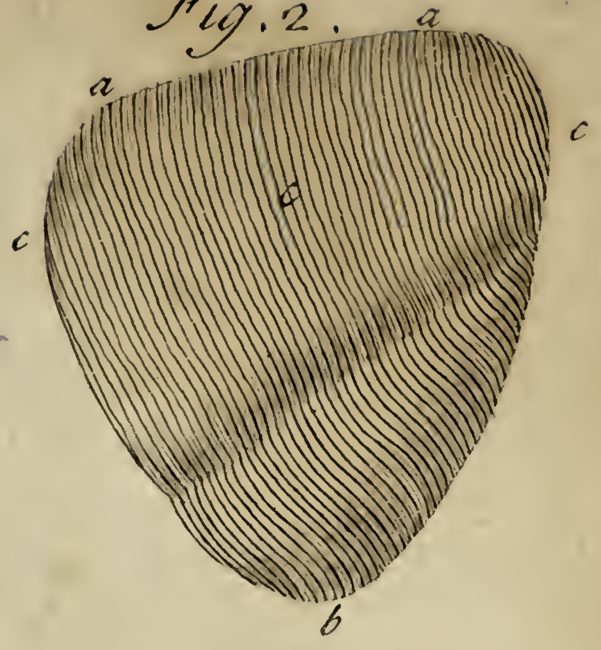


Fig. 3

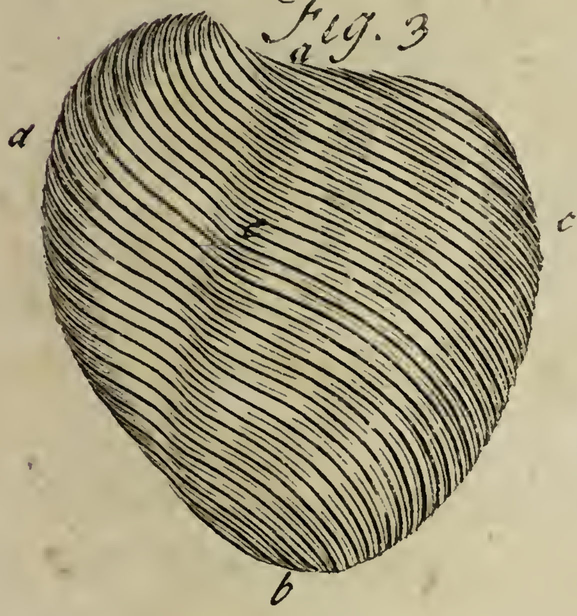
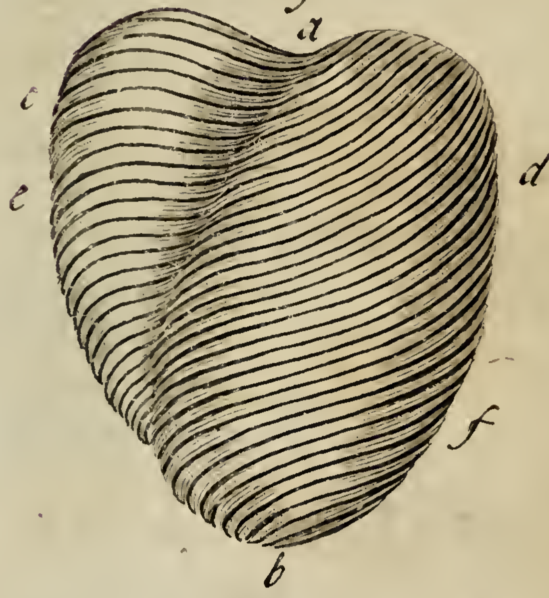


Fig. 4



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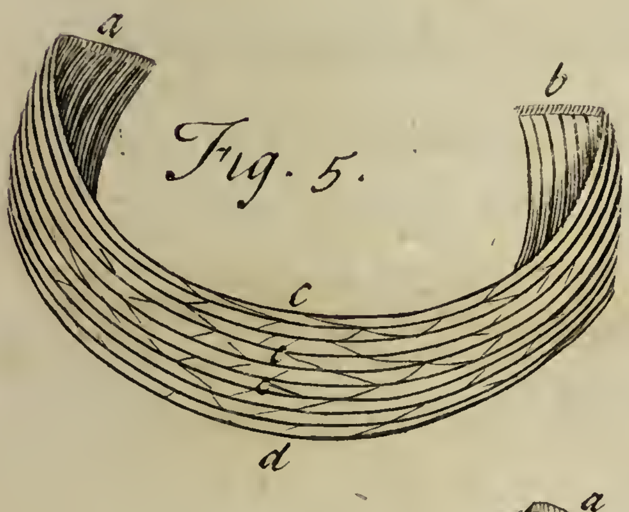
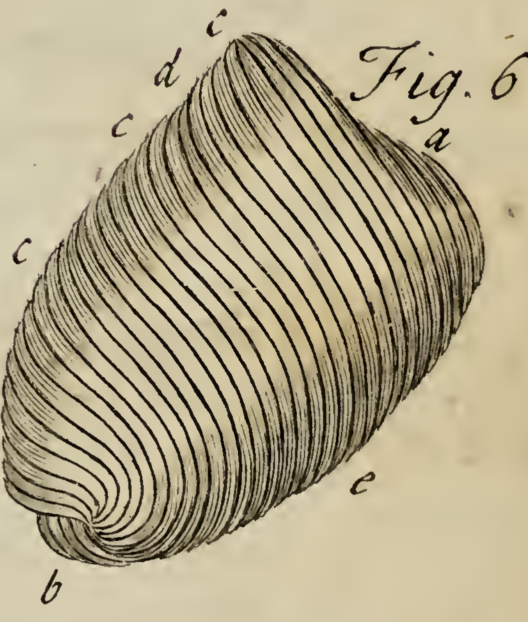


Fig. 6



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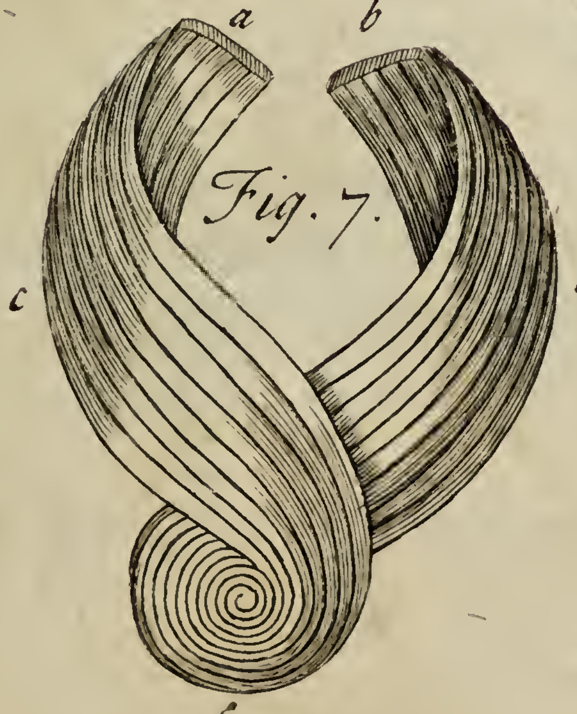

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c. The Fibres which form the left Ventricle.

d. The Fibres which form the right.

e. The Sinus between the two Ventricles where the Veſſels run.

FIGURE IV.

Repreſents the third Plan of Fibres.

a. The Baſe of the Heart.

b. The Cone.

c. The right Side.

d. The left Side.

e. *f*. The Fibres of the $\left\{\begin{array}{l}\text{Right and}\\\text{Left Ventricle.}\end{array}\right.$

FIGURE V.

Repreſents the complicated Fibres which run from the right to the left Ventricle.

a. *b*. The Tendons ſurrounding the Mouth of the $\left\{\begin{array}{l}\text{right and}\\\text{left Ventricle.}\end{array}\right.$

c c c. Fibres running from one Tendon to the other, mutually complicating with one another by intermediate Fibres.

d. The Place where the Fibres (after ſurrounding the right Ventricle) are bent, and mount obliquely to be inſerted into the Tendon of the left Ventricle.

FIGURE VI.

To ſhow how the Fibres, forming and ſurrounding the left Ventricle, turn in a ſhort ſpiral Curve at the Cone, and mount obliquely towards the right Ventricle to be inſerted into the Tendons of the Baſe of the Heart.

a. The Baſe.

b. The Cone with the ſhort ſpiral Curve.

c. The Fibres aſcending obliquely towards the Baſe of the Heart.

d. The Right Side.

e. The Left.

FIGURE VII.

Repreſents the Communication of the interior and exterior Fibres which mutually wreathing about one another, form the Cone of the Heart.

a. The Tendons on the { Right and
b. Left Side.

c. The Exterior Fibres.

d. The Interior.

e. The Fibres of both wreathing the Cone of the Heart.

FINIS.